

Phone: 22541244 Fax: 25534043

Email: purchase@iiap.res.in Website: www.iiap.res.in



INDIAN INSTITUTE OF ASTROPHYSICS

IIND BLOCK, SARJAPUR ROAD, KORAMANGALA,
BANGALORE-560 034

PUBLIC TENDER NOTICE NO:PR/PT/KA/ELE/SPV/CAP/292 DATED 10TH AUGUST 2015

The Director, Indian Institute of Astrophysics invites Quotations/Bids **Two Bid System** (Both Technical & Commercial bid) from reputed firms for the following:-

Sl.No.	Description In Brief	Quantity	E.M.D (refundable) Rs.	Tender Fee (non-refundable) Rs.
01.	Supply & Installation of Grid Integrated Solar Photovoltaic Power Generating System of Capacity 100 KWP (As per detailed specification in the Annexure-I)	01 No.	2,50,000/-	500/-

Note: The Tender documents with Specification details are available on IIA website www.iiap.res.in/tenders.htm. Hence the interested tenderers may at their option download the same from our website (as no hard copies of Tender documents is/are provided from this office) and submit their offer Technical / Commercial bid along with EMD (refundable) & Tender fee (non-refundable) prescribed therein, only in the form of Demand Draft drawn in favour of Director, IIA. However, your offer with Techno / Commercial bid should be Superscribed in an envelope mentioning the tender notice no., Date of opening, and submit the Techno / Commercial bid in a sealed envelope addressed in favour of Director, Indian Institute of Astrophysics, Bangalore – 560 034.

02. The firms who fulfil the following requirements shall be eligible to submit their bid. Joint ventures are not acceptable.

- Tendering Company shall be professionally managed and equipped with facility for the supply and maintenance of tendered items.
- The tenderers should have completed, the last 3 financial years (i.e., current year and two previous financial years) at least one similar single work for a minimum value of Rs.1.2 Crores.
- The total contract amount received during the last 3 financial years, and the current financial year should be minimum of 150% of the above mentioned value. The tenderer should submit Audited Balance Sheet duly certified by the chartered accountant to this effect. They should also submit Bankers Solvency certificate to a minimum of Rs.1.2 Crores.
- The Private Body Contractor shall be required to produce the TDS Certificate indicating the Income Tax deducted by the client for the execution of similar items, completed individually of value not less than Rs.1.2 Crores.

03. The Bid supported by the above information should be submitted in Sealed envelopes duly Superscribed with the name of work/item. The completed bid Technical & Commercial bid will be received by this office **upto 15.00 Hrs. latest by 10th September 2015.**

04. If any information furnished by the tenderers is found incorrect at a later stage, the firm shall be liable to be debarred from tendering and taking up of work in IIA. The Institute reserves the right to verify the particulars furnished by the tenderers.

05. The interested tenderers may contact Mrs.K.Anupama (Ph.No.22541382) to discuss Technical Clarification and Mr.Y.K.Raja Iyengar (Ph.No.22541244) for Commercial Clarification, if any, with prior permission on or before 31st August 2015, before submitting bids.

06. The firms should submit the bids superscribed along with EMD and Tender fee of prescribed amount **upto 15.00 Hrs. Latest by 10th September 2015.** The Techno / Commercial bids will be opened in presence of the bidders or their authorized representatives **at 15.30 Hrs. on 10th September 2015.**

07. Incomplete bids are liable for rejection.

08. Late / delayed offer will not be considered.

09. IIA is not responsible for any delay / loss of documents in transit.

10. No bids will be considered if prescribed Tender Fee and EMD is not found with the Technical bid.

11. The offer should be valid for a minimum period of 120 days from the date of opening of bid.

12. The Commercial / Price bids will be opened in the presence of vendors of the representatives only for those vendors quotes qualified in Technical valuation. The opening of Commercial bids date will be intimated later. However, the decisions for finalization shall be done by a Technical Evaluation Committee being nominated for this purpose approved by the Head of the Institution.

13. IIA reserves the right to reject any or all tenders without assigning any reasons.

**Administrative Officer
IIA, Bangalore-34**

ANNEXURE - I

GRID INTEGRATED SOLAR PHOTOVOLTAIC POWER GENERATING SYSTEM OF CAPACITY 100 KWp

1.0 Introduction

Government of India is laying great emphasis on reducing the country's carbon footprint. In this pursuance, the Hon'ble Prime Minister of India has on 30th June, 2008 released the National Action Plan for Climate Change (NAPCC). One of the NAPCC missions is the *National Solar Mission* and it aims to increase the share of solar energy in India's overall energy mix. Accordingly, Indian Institute of Astrophysics accords high priority to harnessing of solar energy. The energy generated by grid integrated solar photovoltaic system will be utilized to feed IIA's electrical loads during daytime. As a result, during daytime, the purchase of electricity from the electricity authority will get reduced. The surplus generated, if any, will be supplied to grid through net metering facility.

2.0 Scope

2.1. Supply, installation and commissioning of Grid Integrated Solar Photovoltaic Power Plant system of capacity 100 KWp.

2.2. Service the facility as and when required under warranty and should provide guaranteed service either/or under AMC for the entire plant including subsystems for atleast 10years.

2.3. The company should be able to provide operational support to IIA as and when required.

2.4. The company should get all the statutory clearances for the operation of the plant from all the concerned agencies. IIA will provide required documents for the same.

3.0 Eligibility

3.1. Companies who are channel partners with Ministry of Natural Resources and Environment (Accredited under "Grid Connected Rooftop and Small Solar Power Plants Programme"), Government of India, can bid.

3.2. The companies should have consistent rating of "1A" by CRISIL or equivalent rating by reputed standard rating agencies such as ICRA, CARE, FITCH etc for the last five years.

3.3. The companies should have the consistent track record of installing and commissioning equal or higher capacity Grid Integrated Solar Photovoltaic Power Plants during the last three years.

3.4. The companies should be system integrators and manufactures of major subsystems. However, all the subsystems should meet all the standards as given in subsequent sections.

4.0 Reference Standards

All the bidders have to adhere to the Reference Standards as given in Table 4.1

IS: 12834:1989 (reaffirmed 2000)	Solar Photovoltaic Energy Systems –Terminology
IEC : 61215 Ed 2 or latest	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval
IEC: 61730 Pt 1 & 2	Photovoltaic (PV) module safety qualification- Part 1: Requirements for construction Part 2: Requirements for testing
IEC: 61701	Salt mist corrosion testing of photovoltaic (PV) modules
IEC:60904-1(2006)	Photovoltaic Devices- Part-I: Measurement of Photovoltaic current-Voltage Characteristic
IS: 9000	Basic environmental testing procedure for Electronic and electrical items.
IEC:60068	Environmental testing
IEC 61723 Ed1.0	Safety Guidelines for grid connected photovoltaic systems mounted on the buildings
IEC 60364-7-712 (2002)	Electrical Installations of Buildings Part 7: requirements for special installations or locations Section, 712: Photovoltaic power supply systems.
IEC 62446 (2009)	Grid integrated photovoltaic systems- Minimum requirements for system documentation, commissioning tests and inspection

Note: Latest version of the specification shall be referred to.

Table 4.1 - Reference Standards

5.0 System Description

5.1 Solar Photovoltaic (SPV) grid connect system shall consist of mainly the following: -

- i. Solar panels
- ii. Module mounting structure
- iii. Junction boxes
- iv. Solar Grid Inverter (SGI)
- v. Import & Export metering
- vi. Cable, safety components and other accessories
- vii. Earthing system
- viii. Module for remote monitoring
- ix. Lightning arrestor

5.2 The PV array converts the light energy of the sun to DC power. The module mounting structure shall be used to hold the module in position. The DC power

shall be converted to AC by SGI to supply AC loads such as computers, lights, fans, etc. within the IIA premises. Solar power shall be integrated with the premises power supply from electricity authority.

5.3 DC distribution board/ combiner shall be provided in between solar array and SGI. It shall have DC Disconnect / MCCB of suitable rating for connection and disconnection of array section. Type II Surge Arrestor should be incorporated for surge protection. It shall have meters for measuring the array voltage and array current locally and remotely.

5.4 AC distribution board shall be provided in between SGI and loads. It shall have an integrated energy meter, voltmeter and ammeter. Class I + II (as per IEC 62305) 100 kA Surge Arrestor should be incorporated for protection against surges.

5.5 No electrical storage batteries shall be required and accordingly, these are not included in the scope of work.

5.6 The system shall comply to IEC 60364-7-712 and 62446.

6.0 General Requirements

6.1 Solar generating system shall supply part/ full load of IIA.

6.2 The PV system shall reduce the electric energy units drawn by IIA from the grid and thereby reduce CO₂ emissions.

6.3 Solar panels and array junction boxes shall be installed on shade free roof while the SGI/ grid tie string inverter and distribution boards, etc. shall be housed inside the room provided by IIA.

6.4 Statutory approval of local authorities/state electricity distribution company, etc. shall be obtained by the vendor. It is vendor's scope and responsibility to supply, install and commission net metering system and finally get all the statutory clearances.

6.5 IIA shall provide a shadow free area @ 125 - 150 sq.ft./KWp of solar array.

6.6 Array structure of PV yard and all electrical equipments such as SGI, panels etc. shall be grounded properly. Towards this end, the contractor will supply and install an adequate number and appropriate size of IS:3043 - 1987 compliant earthing kits; at least one each for AC circuit, DC circuit and lightning protection system.

6.7 Suitable marking shall be provided on the bus for easy identification.

6.8 PV modules may be connected in series up to the maximum allowed operating voltage of the PV modules and the PV inverter, whichever is lower.

6.9 The reverse current of blocking diodes (connected in series) used shall be rated for 2 X VOC STC of the PV string.

6.10 Proper sealing arrangements at the points of cables entering the enclosures/ buildings should be incorporated. Although not mandatory, manufacturers are however encouraged that the cables entering into the outdoor enclosures be sealed with modular EPDM based cable sealing and protection system based on multi-diameter technology.

7.0 Technical Requirements

7.1 The DC output from the modules shall be fed to array junction box and the strings are paralleled at sub Main & Main junction boxes. Then SGI shall convert DC energy produced by the solar array to AC energy. The AC power output of the inverter shall be fed to the AC distribution board (metering panel & isolation panel), which also houses the energy meter.

7.2 The system shall automatically wake-up in the morning and supply power, provided there is sufficient solar energy and the grid voltage and frequency are in range.

7.3 When the grid voltage and/or frequency goes out of preset range, the inverter shall be immediately disconnected from the grid. The inverter will reconnect after a pre-determined time when the grid is back in the range.

7.4 Array to inverter voltage drop shall be less than 3% at the maximum power output of the array.

7.5 Adequate space and ventilation shall be provided for the inverter.

7.6 For safety reasons, PV inverter system shall be disconnected from the network following a fault or loss of supply on the power network.

7.7 The performance and generation data shall be recorded using a data logger. The monitoring system shall comprise of the following main components:

7.7.1 **SGI** will log performance data and transmit the same to the data logger. It shall also monitor basic parameters like power generated, etc.

7.7.2 **Data logger** shall gather information and monitor the performance of the inverter. It shall also support measurements from the external sensors. Data Logger shall also monitor the Solar Insolation and Temperature of Array Yard.

7.7.3 **Data logging system/ software** shall enable automatic long-term storage of measured data from PV plant. It shall allow visualization, monitoring, commissioning and service of the installation. The data logger shall be web

enabled. It should be possible to access the data logger with any standard web browser like internet explorer, google chrome, etc. and for this purpose, relevant software/ hardware will be supplied by the contractor. In addition to the web portal, it should also be possible to retrieve the data directly from the data logger. The software for access/ visualization of data from data logger should be provided by the supplier free of cost. Necessary executable files, if any, will be required to be given free of cost by the supplier on a CD/ any other storage device.

7.7.4 Communication interface

The system should offer RS232/RS485 port and LAN/ WAN interface to facilitate remote monitoring of the system.

7.8 Scalability of the SPV system

Scalability of the system will be decided by IIA should on the basis of its electrical load requirements. Hence, seamless integration of additional SPV as and when required should be possible.

7.9 SPV Module

7.9.1 Individual Solar PV Module should be of minimum capacity 240 Wp conforming to IEC:61215 Ed 2 or latest - Edition II, IEC : 61730 - I:2007, IEC : 61730 - II : 2007, manufactured in a plant certified under ISO 9001 : 2008 and type tested by an accredited national/international testing laboratory. The Solar PV Module should be made from mono/poly crystalline Silicon Solar Cell connected in series. Imported SPV module or cell will not be accepted, unless MNRE's policy/ rules permit the same. PV modules must qualify Salt Mist Corrosion Testing as per IEC 61701.

7.9.2 SPV modules of similar output with +5Wp tolerance in single string shall be employed to avoid array mismatch losses.

7.9.3 SPV module shall contain crystalline high power silicon solar cells. The solar cell shall have surface anti-reflective coating to help to absorb more light in all weather conditions.

7.9.4 Photo-electric conversion efficiency of SPV module shall not be less than 14%.

7.9.5 Fill factor of the module shall not be less than 72%.

7.9.6 Each module shall have low iron tempered glass front for strength and superior light transmission. It shall also have tough multilayered polymer back sheet for environmental protection against moisture and provide high voltage electrical insulation. Transmittivity of glass shall not be less than 91%.

7.9.7 Module junction box and terminal block (weather resistant) shall be designed for long life outdoor operation in harsh environment.

7.9.8 Bird spike shall be provided so as to avoid bird sitting on the solar modules at the highest point of the array/module structure.

7.9.9 SPV module shall be highly reliable, light weight and shall have a service life of more than 25 years. SPV modules shall have a limited power loss of not more than 10% of nominal output at the end of 10 years and of not more than 20% of nominal output at the end of 25 years.

Type	Crystalline Silicon
Origin	Manufactured in India
Efficiency	$\geq 15\%$
Fill factor	$\geq 70\%$
Degradation warranty	Panel output (W_p) capacity to be $\geq 90\%$ of design nominal power after 10 years and $\geq 80\%$ of design nominal power after 25 years.
Module frame	Non-corrosive and electrolytically compatible with the mounting structure material
Termination box	Thermo-plastic, IP 65, UV resistant
Blocking diodes	Schottky type
Module minimum rated power	The nominal power of a single PV module shall not be less than 240Wp. The output of any supplied module shall not be less than the rated output and shall not exceed the rated power by more than 5Wp. Each module, therefore, has to be tested and rating displayed.
RF Identification tag data (RFID)	<p>Shall be provided inside the module and must be able to withstand environmental conditions and last the lifetime of the solar module.</p> <ol style="list-style-type: none"> Name of the manufacturer of PV Module Name of the Manufacturer of Solar cells Month and year of manufacture (separately for solar cells and module) Country of origin (separately for solar cells and module) I-V curve for the module W_m, I_m, V_m and FF for the module Unique Serial No and Model No of the module Date and year of obtaining IEC PV module qualification certificate Name of the test lab issuing IEC certificate Other relevant information on traceability of solar cells and module as per ISO 9000 standard
Power output rating	To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted.
Compliance with standards and codes	IEC 61215 / IS 14286 IEC 61730 Part 1 and 2
Salt Mist Corrosion Testing	As per IEC 61701

Table 7.1 : Specifications on Solar Photovoltaic Modules

7.10 Module Mounting Structure:

The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels. The structure shall be designed

to allow easy replacement of any module and shall be in line with the site requirements.

Wind velocity withstanding capacity	150 km / hour
Structure material	Hot dip galvanised steel with a minimum galvanisation thickness of 120 microns or aluminium alloy.
Bolts, nuts, fasteners, panel mounting clamps	Stainless steel SS 304 (unbrako/TVS)
Mounting arrangement for RCC-flat roofs	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15
Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the substructure, ensuring that the roof remains water proof and ensuring stability and wind withstanding capacity.
Mounting arrangement for elevated structures	The elevated structure has to be securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces.
Mounting arrangement for ground installations	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15; assuring enough ground clearance to prevent damage of the module through water, animals and other environmental factors
Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.
Minimum distance between roof edge and mounting structure	0.6m
Access for panel cleaning and maintenance	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box.
Panel tilt angle	North - south orientation with a fixed tilt angle of 11 - 13 degrees (depending on location), south facing to provide maximum efficiency

Table 7.2 : Mounting Structure Requirements

7.11 JUNCTION BOXES:

i. The module junction box (if any) shall be certified as per IEC 61215. Else, they should have the same properties as mentioned for array junction boxes. Array sub-main and main junction boxes, shall have the following properties:

- a. They shall be dust, vermin & waterproof and made of Polycarbonate - Glass Fibre Substance (PC-GFS) thermoplastic. The enclosure should be double insulated with protection class II as per IEC 61439-1. Material and the protection class shall be marked on the enclosure.
- b. The enclosure shall have a transparent front lid for enabling easy visibility.

- c. The enclosures shall have IP 65/IP66 protection in accordance with IEC 60529. Third party conformance certificate is required to be given for IP 65/ IP 66 degree of protection.
 - d. Minimum requirements for fire protection in the event of internal faults: Glow wire test in accordance with IEC 60 695-2-11 at 9600C for box and 850°C for conducting components
 - e. Burning Behaviour: Base part of Polycarbonate Enclosure shall be UL94-V-0 compliant and Lid part of PC Enclosure shall be UL94-V-2 compliant.
 - f. The enclosures shall have IK 08 degree of protection for mechanical load.
 - g. The material used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC.
 - h. The enclosure shall have a usage temperature rating of -10°C to 55°C.
 - i. The enclosure should be chemically resistant to acid, lye, petrol, mineral oil & partially resistant to benzene.
 - j. The enclosures shall have a rated insulated voltage of 1000V DC and dielectric strength of 4.65 KV DC.
 - k. The material of the enclosure shall be UV stabilized.
 - l. Though not mandatory, manufacturers are encouraged to provide breather glands in the array junction boxes to prevent overheating and explosions. The properties mentioned above should be demonstrated through datasheet of the manufacturer.
- ii. SPDs Class II as per IEC 61643-1, shall be used at the terminals of array junction boxes for external surge protection. Internal Surge protection (SPDs) shall consist of three MOV type arrestors connected from + ve and - ve terminal to earth (Via Y arrangement) for higher withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have safe disconnection & short circuit interruption arrangement through integrated DC in-built bypass fuse (parallel) which should get tripped during failure mode of MOV, extinguishing DC arc safely (created by inbuilt thermal disconnection) in order to protect the installation against fire hazards. Nominal discharge current (In) at 8/20 microseconds shall be minimum 10 KA with maximum discharge current (Imax) of minimum 20KA at 8/20microseconds with visual indication (through mechanical flag) in all modules to monitor the life of SPD. The I_{scwpv} (Short Circuit current withstand capacity of arrester) should be at least 10% more than Nominal output current of the combiner box and AJB. Detailed internal schematic for the above SPDs, compliant to these specifications, should be submitted by the manufacturers.

iii. The junction boxes shall have suitable cable entry points with cable glands of appropriate sizes for both incoming and outgoing cables. Though not mandatory, manufacturers are encouraged to provide suitable cable entry points fitted with MC-4 Connectors.

iv. Suitable markings should be provided on the bus bar for easy identification, and cable ferrules shall be fitted at the cable termination points for identification.

v. The Array Junction Box should preferably have maximum 08input and 01 output with SPD and Terminal block.

7.12 EARTHING FOR PV ARRAY, BALANCE OF SYSTEM (BOS) AND OTHER COMPONENTS AND LIGHTNING PROTECTION

- i. The photovoltaic modules, Balance of system (BOS) and other components of power plant require proper grounding for protection against any serious faults as guided by IEC 60364.
- ii. The earthing resistance must not exceed the limits generally in practice for such applications.
- iii. The Bidder shall submit the detailed scheme of earthing and grounding.
- iv. The contractor will supply and install an adequate number and appropriate size of IS:3043 - 1987 compliant earthing kits; at least one each for AC circuit, DC circuit and lightning protection system.
- v. The source of over voltage can be lightning or other atmospheric disturbance. Main aim of over voltage protection is to reduce the overvoltage to a tolerable level before it reaches the PV or other sub-system components. Lightning protection should be provided as per IEC 62305.
- vi. Necessary concrete foundation or any other arrangement for holding the lightning conductor in position is to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.
- vii. The lightning conductor and structures shall be earthed through flats as per applicable Indian Standards with earth pits. Each lightning conductor shall be fitted with individual earth pit as per required Standards including accessories, and providing masonry enclosure. Else, a matrix of lightning conductors is to be created which will be required to be connected to an earth.
- viii. If necessary, more numbers of lightning conductors may be provided.
- ix. The Bidder shall submit the drawings and detailed specifications of the PV array lightning protection equipment.

7.13 SOLAR GRID INVERTER (SGI)

SGI shall supply the DC energy produced by array to DC bus for inverting to AC voltage using its MPPT (Maximum Power Point Tracking) control to extract maximum energy from solar array and produce 415V (+15% and -20%) AC, 3 phase, $50 \pm 5\%$ Hz (47.5 to 52.5 Hz) to synchronize with the local grid. The array output should be well within the input voltage range of the inverter so that the inverter works in MPPT range for most of the solar insolation range. This should be applicable for the whole life of the solar array and needs to be substantiated through design calculations. SGI should be able to handle maximum open circuit DC voltage of 1,000V.

The inverter shall be efficient with Insulated Gate Bipolar Transistor IGBT based reliable design. The control system should be of highest reliability preferably based on Digital Signal Processors. The SGI shall be capable of complete automatic operation, including wake-up, synchronization and shut down.

SGI shall be able to synchronize independently and automatically/ phase-lock with POWER SUPPLY AUTHORITY grid power line frequency to attain synchronization.

SGI can be a combination of multiple string (10 to 20 KWp each) inverters for the total capacity of SPV (100KWp).

Total output power (AC)	To match solar PV plant capacity while achieving optimum system efficiency
Input DC voltage range	As required for the solar grid inverter DC input.
Maximum power point (MPPT) tracking	MPPT controller, inverter and associated control and protection devices, etc. all shall be integrated into the SGI
Number of independent MPPT inputs	1 or more
Operation AC voltage	SGI/ string inverter shall provide 3 phase, 415V (with grid tracking of +15%/-20%),
Operating Frequency range	50 Hz (with grid tracking of $\pm 5\%$ i.e. 47.5 to 52.5 Hz) supply on AC side with voltage Third Harmonic Distortion of less than 3% and current Third Harmonic Distortion of less than 3%.
Power factor of the inverter	>0.98 at nominal power
Built-in Protection	<p>Degree of protection will be minimum IP20 for non-electronics portion where transformer, etc are mounted, if any and for the rest of the portion including electronics, it will be IP31 for units of capacities upto 15KWp and IP41 for units of capacities greater than 15KWp. IP 65 for outdoor mounting, IP 54 for indoor mounting.</p> <p>Following is the list of protections :</p> <ul style="list-style-type: none"> ➤ Over-voltage both at input and output ➤ Over-current both at input and output ➤ Over/under grid frequency ➤ Over temperature

	<ul style="list-style-type: none"> ➤ Short circuit on AC side ➤ Reverse polarity protection ➤ Array ground fault protection ➤ Protection against lightning induced surges Class II, 10 kA as per IEC 61643-1 ➤ Protection against surge voltage induced at output due to external source ➤ Anti-islanding protection : As per VDE 0126-1-1, IEC 60255.5 /IEC 60255.27
Operating ambient temperature range	-10°C - +60°C
Humidity	0 - 95% Rh
Inverter efficiency (Transformer-less design)	≥95%
Inverter weighted efficiency (Transformer-less design)	≥94%
Communication interface	RS 485 / RS 232
Environment tests (as per IEC 60068/ IS 9000)	<ul style="list-style-type: none"> a) Dry Heat Test: 50°C±2°C for 16 hours b) Damp Heat Test (Steady state): 40°C, 93% RH for 4 days c) Damp Heat Test (Cyclic): 40°C, 93% RH for 6 cycles (duration of one cycle shall be 24hrs) d) Cold Test: 0°C for 16 hours e) Change of temperature Test: -10°C/-5°C to 50°C for 3 cycles (rate of change in temperature shall be 3°C per minute)
EMI and EMC Requirements	<p>System shall comply the following EMI and EMC requirements:</p> <ul style="list-style-type: none"> i. Emitted interference as per IEC: 61000-6-4. ii. Interference emitted as per IEC: 61000-6-2.
Noise level	Should be less than 65 dBA (nominal) at 1m.
Safety compliance	IEC 62109-1, IEC 62109-2
Display type and display parameters	<p>LCD for data display. LCD / LED for status display</p> <ul style="list-style-type: none"> ➤ Inverter ON ➤ Grid ON ➤ Inverter under voltage/over voltage ➤ Inverter over-load ➤ Output power (W), ➤ Cumulative energy (Wh), ➤ DC voltage (V), ➤ DC current (A), ➤ AC voltage (V), ➤ AC frequency (Hz), ➤ AC current (A), ➤ Cumulative hours of operation (h) ➤ Inverter over-temperature ➤ Earth Fault

Table 7.3 : Specifications of SGI

7.14 Cables and Hardwares

The cables used in module/ array wiring shall be TUV 2Pfg 1169/08.2007 or VDE EPV 01:2008-02 or UL4703 certified. Cables of appropriate size to be used in the rest of the system shall have the following characteristics:

- i. Temp. Range -10°C to $+120^{\circ}\text{C}$.
- ii. Voltage rating 600/1000V
- iii. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation, ozone and weathering
- iv. Halogen-free, fire retardant, low smoke, low toxicity.
- v. Flame retardant
- vi. Flexible, bending radius to suit site requirements.
- vii. Fulfills IEC 60332-1 requirements. Accredited lab test report/Manufacturer's test report shall be attached.
- viii. Conductor class IEC 60228 class 5. Accredited lab test report/Manufacturer's test report shall be attached.

7.14.1 Cabling on DC side of the system shall be as short as possible to minimize the voltage drop in the wiring.

7.14.2 Components and hardware shall be vandal and theft resistant. All parts shall be corrosion-resistant.

7.14.3 Voltage drop on the DC side from array to the inverter should not be more than 3%. Necessary calculations in this regard shall also be submitted during design approval.

7.14.4 Overload protection may be omitted to PV string and PV array cables when the continuous current-carrying capacity of the cable is equal to or greater than 1.25 times ISC STC at any location. Necessary calculations in this regard shall be submitted during design approval.

7.14.5 Overload protection may be omitted to PV main cable if the continuous current-carrying capacity of the cable is equal to or greater than 1.25 times ISC STC of the PV generator. Necessary calculations in this regard shall be submitted during design approval.

7.15 The system description, general/technical requirements, etc. are given for general guidance only. The supplier/manufacturer shall submit the detailed design of the complete solar generating system by using their software to optimize the combination of modules considering the specific location, insolation, nature of load, etc.

7.16 AC Distribution Board (ACDB):

The ACDB must have the following features:

- i. Bus Bar should be minimum 3 times capacity of Solar Power plant.

- ii. Input Grid Line should come from such Distribution Board of client so that the IIA load is fed parallelly by the grid as well as SPV system.
- iii. The Solar Power should be exported to the bus bar inside the ACDB through a LCD Energy Meter.
- iv. The Designated Load should be routed through ACDB and an Energy Meter to register the Load Energy Consumption from Solar and Grid during Week Days and Holiday.
- v. The SPV system will help IIA to obtain GRIHA/ECBC certification for the buildings.
- vi. ACDB should have Class I + II (as per IEC 62305; IEC 61643 and IEC 60364-5-53), 100 kA Surge Suppression inbuilt for surge protection. Surge protection on AC side (Type 1 + Type 2) shall consist of Pre wired metal encapsulated spark gap based solution for fire safe and fire proof operation at site, consisting of base part and plug in protection modules. Total discharge capacity/Lightning Impulse current (Iimp) at 10/350 μ sec and nominal discharge current (In) at 8/ 20 μ sec shall be minimum 100 KA for three phase power supply system and 50 KA for single phase power supply system. The discharge capability of L-N connected module shall be 25 KA at 10/350 μ sec and 8/20 μ sec. All the L-N & N-E connected arresters shall have built in mechanical health indication. Complete solution shall have voltage protection level (Up) of \leq 1.5 KV to protect the sensitive electronics inside the Invertors, having follow current extinguishing and limiting capability up to 25 KA rms (at 255V) without tripping of even small rating 32 AGL/ gG fuse and approved from international independent test labs like KEMA or VDE or UL as per latest IEC 61643-1 or equivalent EN 61643-11 standard. SPDs on the ACDB shall be provided if the same haven't been provided on the SGI.

8.0 INSTALLATION & COMMISSIONING:

The installation and commissioning shall be done by the supplier/manufacturer who is responsible for system performance, direction of installation and structural stability. The supplier shall conduct a detailed site assessment. The PV installer shall obtain data specific to the site, rather than relying on general data. While making foundation design, due consideration shall be given to weight of the module assembly, maximum wind speed at the site, etc.

9.0 DOCUMENTATION:

The supplier shall provide easy-to-use illustrated installation and operation manual in English for easy installation and trouble-free usage. Manual shall contain complete system details such as array layout, schematic of the system, working principle, clear instruction on regular maintenance, trouble-shooting of the solar generating system, emergency shut down procedure, etc.

10.0 AFTER SALES SERVICE:

The complete details of service centers in India shall be provided along with the offer. All essential materials and manpower shall be placed at the service centers to ensure quick and efficient after sales service. Any spares to be procured may be specified by vendor.

11.0 : Compliance Matrix

11.1. Vendors are requested to fill the compliance matrices (tables) 11.1 to 11.4 for technical evaluation.

11.2. They should also ensure that they meet all the other criteria discussed/listed in different section of the RFP for technical evaluation.

Table 11.1 : Solar Panel

Sl No	Item	Description	Compliance Yes/No	Remarks if any
1	Type	Crystalline Silicon		
2	Origin	Manufactured in India		
3	Efficiency	$\geq 15\%$		
4	Fill factor	$\geq 70\%$		
5	Degradation warranty	Panel output (W_p) capacity to be $\geq 90\%$ of design nominal power after 10 years and $\geq 80\%$ of design nominal power after 25 years.		
6	Module frame	Non-corrosive and electrolytically compatible with the mounting structure material		
7	Termination box	Thermo-plastic, IP 65, UV resistant		
8	Blocking diodes	Schottky type		
9	Module minimum rated power	The nominal power of a single PV module shall not be less than 240Wp. The output of any supplied module shall not be less than the rated output and shall not exceed the rated power by more than 5Wp. Each module, therefore, has to be tested and rating displayed.		
10	RF Identification tag data (RFID)	<p>Shall be provided inside the module and must be able to withstand environmental conditions and last the lifetime of the solar module.</p> <ol style="list-style-type: none"> Name of the manufacturer of PV Module Name of the Manufacturer of Solar cells 		

		<ul style="list-style-type: none"> 3. Month and year of manufacture (separately for solar cells and module) 4. Country of origin (separately for solar cells and module) 5. I-V curve for the module 6. W_m, I_m, V_m and FF for the module 7. Unique Serial No and Model No of the module 8. Date and year of obtaining IEC PV module qualification certificate 9. Name of the test lab issuing IEC certificate 10. Other relevant information on traceability of solar cells and module as per ISO 9000 standard 		
11	Power output rating	At standard test conditions (STC). I-V curve of the sample module shall be submitted.		
12	Compliance with standards and codes	IEC 61215 / IS 14286 IEC 61730 Part 1 and 2		
13	Salt Mist Corrosion Testing	As per IEC 61701		

Table 11. 2: Module Mounting Structure

Sl No	Item	Description	Compliance Yes/No	Remarks if any
1	Wind velocity withstanding capacity	150 km / hour		
2	Structure material	Hot dip galvanised steel with a minimum galvanisation thickness of 120 microns or aluminium alloy.		
3	Bolts, nuts, fasteners, panel mounting clamps	Stainless steel SS 304 (unbrako/TVS)		
4	Mounting arrangement for RCC-flat roofs	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15		
5	Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the substructure, ensuring that the roof remains water proof and ensuring stability and		

		wind withstanding capacity.		
6	Mounting arrangement for elevated structures	The elevated structure has to be securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces.		
7	Mounting arrangement for ground installations	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15; assuring enough ground clearance to prevent damage of the module through water, animals and other environmental factors		
8	Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.		
9	Minimum distance between roof edge and mounting structure	0.6m		
10	Access for panel cleaning and maintenance	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box.		
11	Panel tilt angle	North - south orientation with a fixed tilt angle of 11 - 13 degrees (depending on location), south facing to provide maximum efficiency		

Table 11.3: Junction Boxes

Sl No	Description	Compliance Yes/No	Remarks if any
	The module junction box (if any) shall be certified as per IEC 61215. Else, they should have the same properties as mentioned for array junction boxes. Array sub-main and main junction boxes, shall have the following properties:		
1	They shall be dust, vermin & waterproof and made of Polycarbonate - Glass Fibre Substance (PC-GFS) thermoplastic. The enclosure should be double insulated with protection class II as per IEC		

	61439-1. Material and the protection class shall be marked on the enclosure.		
2	The enclosure shall have a transparent front lid for enabling easy visibility		
3	The enclosures shall have IP 65/IP66 protection in accordance with IEC 60529. Third party conformance certificate is required to be given for IP 65/ IP 66 degree of protection.		
4	Minimum requirements for fire protection in the event of internal faults: Glow wire test in accordance with IEC 60 695-2-11 at 960°C for box and 850°C for conducting components		
5	Burning Behaviour: Base part of Polycarbonate Enclosure shall be UL94-V-0 compliant and Lid part of PC Enclosure shall be UL94-V-2 compliant.		
6	The enclosures shall have IK 08 degree of protection for mechanical load.		
7	The material used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC.		
8	The enclosure shall have a usage temperature rating of -10°C to 55°C.		
9	The enclosure should be chemically resistant to acid, lye, petrol, and mineral oil & partially resistant to benzene.		
10	The enclosures shall have a rated insulated voltage of 1000V DC and dielectric strength of 4.65 KV DC.		
11	The material of the enclosure shall be UV stabilized.		
12	Though not mandatory, manufacturers are encouraged to provide breather glands in the array junction boxes to prevent overheating and explosions. The properties mentioned above should be demonstrated through datasheet of the manufacturer.		

Table 11.4: Solar Grid Inverter

Sl No	Item	Description	Compliant Yes/No	Remarks if any
1	Total output power (AC)	To match solar PV plant capacity while achieving optimum system efficiency		
2	Input DC voltage range	As required for the solar grid inverter DC input.		
3	Maximum power point (MPPT) tracking	MPPT controller, inverter and associated control and protection devices, etc. all shall be integrated into the SGI		
4	Number of independent MPPT inputs	1 or more		
5	Operation AC voltage	SGI/ string inverter shall provide 3 phase, 415V (with grid tracking of +15%/-20%),		

6	Operating Frequency range	50 Hz (with grid tracking of $\pm 5\%$ i.e. 47.5 to 52.5 Hz) supply on AC side with voltage Third Harmonic Distortion of less than 3% and current Third Harmonic Distortion of less than 3%.		
7	Power factor of the inverter	>0.98 at nominal power		
8	Built-in Protection	<p>Degree of protection will be minimum IP20 for non-electronics portion where transformer, etc are mounted, if any and for the rest of the portion including electronics, it will be IP31 for units of capacities upto 15KWp and IP41 for units of capacities greater than 15KWp. IP 65 for outdoor mounting, IP 54 for indoor mounting.</p> <p>Following is the list of protections :</p> <ul style="list-style-type: none"> ➤ Over-voltage both at input and output ➤ Over-current both at input and output ➤ Over/under grid frequency ➤ Over temperature ➤ Short circuit on AC side ➤ Reverse polarity protection ➤ Array ground fault protection ➤ Protection against lightning induced surges Class II, 10 kA as per IEC 61643-1 ➤ Protection against surge voltage induced at output due to external source ➤ Anti-islanding protection : As per VDE 0126-1-1, IEC 60255.5 /IEC 60255.27 		
9	Operating ambient temperature range	-10°C - +60°C		
10	Humidity	0 - 95% Rh		
11	<p>Inverter efficiency (Transformer-less design)</p> <p>Inverter weighted efficiency (Transformer-less design)</p>	<p>$\geq 95\%$</p> <p>$\geq 94\%$</p>		
12	Communication interface	RS 485 / RS 232		

1 3	Environment tests (as per IEC 60068/ IS 9000)	<p>f) Dry Heat Test: 50°C±2°C for 16 hours</p> <p>g) Damp Heat Test (Steady state): 40°C, 93% RH for 4 days</p> <p>h) Damp Heat Test (Cyclic): 40°C, 93% RH for 6 cycles (duration of one cycle shall be 24hrs)</p> <p>i) Cold Test: 0°C for 16 hours</p> <p>j) Change of temperature Test: -10°C/-5°C to 50°C for 3 cycles (rate of change in temperature shall be 3°C per minute)</p>		
1 4	EMI and EMC Requirements	<p>System shall comply the following EMI and EMC requirements:</p> <p>iii. Emitted interference as per IEC: 61000-6-4.</p> <p>iv. Interference emitted as per IEC: 61000-6-2.</p>		
1 5	Noise level	Should be less than 65 dBA (nominal) at 1m.		
16	Safety compliance	IEC 62109-1, IEC 62109-2		
1 7	Display type and displayparameter s	<p>LCD for data display. LCD / LED for status display</p> <ul style="list-style-type: none"> ➤ Inverter ON ➤ Grid ON ➤ Inverter under voltage/over voltage ➤ Inverter over-load ➤ Output power (W), ➤ Cumulative energy (Wh), ➤ DC voltage (V), ➤ DC current (A), ➤ AC voltage (V), ➤ AC frequency (Hz), ➤ AC current (A), ➤ Cumulative hours of operation (h) ➤ Inverter over-temperature ➤ Earth Fault 		

Phone: 22541244 **Fax:** 25534043

Email: purchase@iiap.res.in **Website:** www.iiap.res.in

INDIAN INSTITUTE OF ASTROPHYSICS
IInd Block, Koramangala, Bangalore-560 034

No.PR/PT/KA/ELE/SPV/CAP/292

Dated: 10th August 2015

M/s.

Dear Sirs,

The Director, Indian Institute of Astrophysics, Bangalore invites Sealed Tenders for the supply of Stores detailed in the Tender Form hereto attached. The Tender terms enclosed are also may be noted carefully. If you are in a position to quote for the supply in accordance with the requirement, please submit your quotation in the attached Tender Form also.

Your Tender bids must reach this office on or before the date and time indicated in the Tender Schedule.

Thanking you,

Yours faithfully,

Encl: as above.

P.Kumaresan
Administrative Officer

Phone: 22541244 **Fax:** 25534043 **Email:** purchase@iiap.res.in **Website:** www.iiap.res.in

INDIAN INSTITUTE OF ASTROPHYSICS

IInd Block, Koramangala, Bangalore-560 034

PUBLIC TENDER DOCUMENT NO: PR/PT/KA/ELE/SPV/CAP/292 Dated: 10th August 2015

TENDER FORM

FROM:

TO

**THE DIRECTOR,
Indian Institute of Astrophysics.,
Bangalore-560 034.**

Sir,

I/We hereby offer to supply the stores indicated below at the price hereunder quoted and agree to hold this offer open till_____. I/We shall be bound to supply the store hereby offered upon the issue of the Purchase Order communicating to the acceptance thereof on or before the expiry of the last mentioned date. You are at liberty to accept any one or more of the items of such stores. I/We not withstanding that the offer in this tender has not been accepted in whole, shall be bound to supply such items and such portion or portions of one or more of the items as may be specified in the said Purchase Order communicating the acceptance.

SI No	Description	Qty	Unit	Amount Rs.	VAT / ST %	Delivery Period

Place at which the Delivery is required : IIA, 2nd Block, Koramangala, Bangalore - 560034

Date by which the supplies are required : Within 4-6 weeks from the date of receipt of Purchase order.

2. I/We have understood the items of the tender annexed to the invitation to this Public Tender and have thoroughly examined the specifications/drawing and /or pattern quoted or referred to herein and/are fully aware of the nature of the stores required and my/our offer is to supply the stores strictly in accordance with the requirements subject to the terms and conditions contained in the Purchase Order, if communicated on the acceptance of this tender either in whole or in part.

Date:

Signature and seal of Tenderer

TERMS AND CONDITIONS OF CONTRACT

1. DEFINITIONS :

a.) The terms 'Purchaser' shall mean the Director, Indian Institute of Astrophysics, Bangalore -560 034.

b.) The term 'Contractor' shall mean, the person, firm or company with whom or with which the order of stores is placed and shall be deemed to include the Contractor's successors, representative, heirs, executors and administrators unless excluded by the contract.

c.) The 'Stores' shall mean that contractor agrees to supply under the contract as specified in the Purchase Order including erection Plants and machinery and subsequent testing, should such a condition be included in the Purchase Order.

d.) The terms 'Purchase Order' shall mean the communication signed on behalf of the Purchaser by an Officer duly authorized intimating the acceptance on behalf the Purchaser on the terms and conditions mentioned or referred to in the said communications accepting the tender or offer of the contractor for supply of stores or plant, machinery or equipment or part thereof.

2. PRICES :

Tenders, offering firm prices will be preferred, where a price variation clause is insisted upon by a tenderer, quotations with a reasonable ceiling should be submitted. Such offers should variably be supported by the base price taken into account at the time of tendering and also the formula for any such variations.

3. DUTY EXEMPTION :

(a.) Excise duty and customs duty exemption certificate will be provided if considered against the categories of items tendered, under the Govt. of India Notification No. 10/97 and 51/96 valid till 2011.

4. SECURITY DEPOSIT:

On acceptance of Tender, the Contractor shall, at the option of the Purchaser and within the period specified by him deposit with him in cash or any other form as the Purchaser may determine, Security deposit not exceeding ten percent of the value of the contract as the Purchaser shall specify. If the contractor is called upon by the purchaser to deposit 'Security' and the contractor fails to provide the security within the period specified, such failure shall constitute a breach of the contract and purchase shall be entitled to make other arrangements for the re-purchase of the stored contracted for at the risk of contractor in terms of sub-clause (ii) and (iii) of clause 10 (b) hereof and/or to recover from the contractor damages arising from such cancellation.

5. GUARANTEE AND REPLACEMENT :

a.) The contractor shall guarantee that the stores supplied shall comply fully with the specifications laid down, for material workmanship and performance.

b.) For a period of (12) twelve months after the acceptance of the stores, if any defects are discovered therein or any defects therein found to have developed under proper use arising from faulty stores, design or workmanship, contractor shall remedy such defects at his own cost provided

he is called upon to do so within a period of 14 months from the date of acceptance thereof by the purchaser who shall state in writing in what respect the store or any part thereof are faulty.

c.) If in the opinion of the purchaser, it becomes necessary to replace or renew any defective stores such replacement or renewal shall be made by the Contractor free of all costs to the purchaser provided the notice informing the contractor of the defect is given by the purchaser in this regard within the said 14 months from the date of acceptance thereof.

d.) Should the contractor fail to rectify the defects, the purchaser shall have the right to reject or repair or replace at the cost of the contractor the whole or any portion of the defective stores.

e.) The decision of the purchaser, notwithstanding any prior approval of acceptance or inspection thereof on behalf of the purchaser, as to whether or not the stores supplied by the contractor are defective or any defects has developed within the said period of 12 months or as to whether the nature of the defectives required renewal or replacement shall be final, conclusive and binding on the contractor.

f.) To fulfill guarantee conditions outlined in Clause 5(a) to (d) above, the contractor shall, at the option of the purchaser, furnish a Bank Guarantee (as prescribed by the purchaser) from a Bank approved by the purchaser for an amount equivalent to 10% of the value of the contract along with first shipment documents. On the performance and completion of the contract in all respects, the Bank Guarantee will be returned to the contractor without any interest.

g.) All the replacement stores shall also be guaranteed for a period of 12 months from the date of arrival of stores at Purchaser's site.

h.) Even while the 12 months guarantee applied to all stores in case where a greater period is called forth by our specifications then such a specification shall apply; in such cases the period of 14 months referred to in Para 5(b) and (c) shall be 'asked for' guarantee period plus two months.

6. PACKAGING, FORWARDING AND INSURANCE :

The Contractor will be held responsible for the stores being sufficiently and properly packed for transport by rail, road, sea or air, to withstand transit hazards and ensure safe arrival at the destination. The packing and marking of packing shall be done by and at the expenses of the contractor. The Purchaser will not pay separately for transit insurance, all risks in transit being exclusively of the contractor and the Purchaser shall pay only for such stores as are actually received in good condition, in accordance with contract.

7. TEST CERTIFICATE :

Wherever required Test Certificate should be sent along with the relevant dispatch documents.

8. ACCEPTANCE OF STORES :

a) The Stores shall be tendered by the contractor for inspection at such places as may be specified by the purchaser at the Contractor's own risk, expenses and cost.

b) It is expressly agreed that the acceptance of stores, contracted for is subject to final approval by the Purchaser, whose decision shall be final.

c) If, in the opinion of the Purchaser all or any of the stores that do not meet the performance or quality requirements specified in the Purchase Order, they may be either rejected or

accepted at the price to be fixed by the purchaser and his decision as to rejection and the prices to be fixed shall be final and binding on the contractor.

d) If the whole or any part of the store supplied are rejected in accordance with Clause No.8(c) above, the Purchaser shall be at the liberty, with or without notice to the Contractor, to purchase in the open market at the expenses of the Contractor, stores meeting the necessary performance and quality contracted for in place of these rejected, provided that either the purchase, or the agreement to purchase, from another supplier is made within six months from the date of rejection of the stores as aforesaid.

9. REJECTION OF STORES :

Rejected stores will remain at the destination at the Contractor's risk and responsibility, if instructions for their disposal are not received from the Contractor within a period of 14 days from the date of receipt of the advice or rejection, the Purchaser or his representative has, at his discretion the right to scrap or seal or consign the rejected stores to the Contractor's address at the Contractor's entire risk and expense, freight being payable by the Contractor at actuals.

10. DELIVERY PERIOD :

a.) The delivery period of the stores stipulated in the purchase order shall be deemed to be the essence of the Contract, and delivery must be completed on or before the specified dates/period.

b.) Should the Contractor fails to deliver the stores or any consignment thereof within the period prescribed for such delivery, the Purchaser shall be entitled at his option either.

i) to recover from the Contractor as agreed liquidated damages and not by way of penalty, a sum of 2% of the price of any stores which the contractor has failed to deliver as aforesaid for each month or part of a month, during which the delivery of such stores may in arrears, or

ii) to purchase elsewhere, without notice to the Contractor on the account and at the risk of the contractor, the stores not delivered or others of similar description (where other exactly complying with the particulars are not, in the opinion of the purchaser readily procurable, such opinion being final) without canceling the Contract in respect of the consignment(s) not yet due for delivery or,

iii) to cancel the contract or a portion thereof, and, if so desired to purchase or authorize the purchase of stores not so delivered or others of similar description (where other exactly complying with the particulars are not, in the opinion of the purchaser readily procurable, such opinion final) at the risk and cost of the Contractor.

In the event of action being taken under sub-clause (ii) and (iii) of clause 10 above, the Contractor shall be liable for any loss which the Purchaser may sustain on that account, provided that the re-purchase, or if there is an agreement to re-provide shall made within (6) six months from the date of such failure. But the Contractor shall not be entitled to any gain on such re-purchase made against default. It shall not be necessary for the purchaser to serve a notice of such re-purchase on the defaulting Contractor. This right shall without prejudice to the right of the purchase to recover damages for breach of contract by the Contractor.

11. EXTENSION OF DELIVERY TIME :

As soon as it is apparent that Contractor delivery period/dates cannot be adhered to, an application shall be sent by the Contractor to the Purchaser. If failure, on the part of the Contractor to deliver the stores in proper time shall have arisen from any cause which the Purchaser may admit as reasonable ground for an extension of the time (and his decision shall be final he may allow such

additional time as he considers it to be justified by the circumstances of the case without prejudice to the Purchaser's rights to recover liquidated damages under clause 10(i)(ii) and (iii).

12. PAYMENT :

Contractor's bill will be passed only after the stores have been received, inspected and accepted by the Purchaser for payment.

13. RECOVERY OF SUMS DUE :

Whenever there is breach of contract whether liquidated or not, money arising out of or under this contract against the contract, the Purchaser shall be entitled to recover such sum by appropriating, in part or whole, the security deposited by the Contractor, if a Security is taken against the contract. In the event of the Security being insufficient or if no security has been taken from the Contractor, then the balance or the total sum recoverable as the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the contractor under this or any other contract with the Purchaser. Should this sum be not sufficient to cover the full amount recoverable, the Contractor shall pay to the Purchaser on demand the remaining balance due. Similarly, if the purchaser has or makes any claims, whether liquidated or not, against the Contractor under any other contract with the purchaser, the payment of all moneys payable under the contract to the Contractor including the Security Deposit shall be withheld till such claims of the Purchaser are finally adjudicated upon and paid by the Contractor.

14. INDEMNITY :

The Contractor shall warrant and be deemed to have warranted that all stores supplied against this contract are free and clean of infringement of any patent, copy right or trade mark, and shall at all time indemnify the purchaser against all claims which may be made in respect of the stores for infringement of any right protected by patent, registration of design or trade mark and shall take all risk of accidents of damage which may cause a failure of the supply from whatever cause arising and the entire responsibility for sufficiency of all the means used by him for the fulfillment of contract.

15. ARBITRATION:

In the event of any question, dispute or difference arising under these conditions contained in the purchase order in connection with this contract, (except as to any matters the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of the Head of the Institution or of some other person appointed by him. It will be no objection that the arbitrator is a Government Servant, that he has to deal with matter to which the Contract relates or that in the course of his duties as Government Servant he has expressed views on all or any of the matters in dispute binding on the parties of this Contract.

(a)IT IS TERMS OF THIS CONTRACT:

If the Arbitrator be the Head of the Institution.,

i) in the event of his being transferred or vacating his office by resignation or otherwise, it shall be lawful for his successor-in-office either to proceed with the reference himself, or to appoint another person as arbitrator, or,

ii) in the event of his being unwilling or unable to act for any reason, it shall be lawful for the Head of the Institution, to appoint another person as arbitrator or,

(b) If the Arbitrator be a Person appointed by the Head of the Institution:-

In the event of his death, neglecting or refusing to act, or resigning or being unable to act for any reason, it shall be lawful for the Institution either to proceed with reference himself or to appoint another person as arbitrator in place of the outgoing arbitrator. Subject as aforesaid the Arbitration Act, 1940 and the rules there under and any statutory modifications thereof for the time being in force shall be deemed to apply to the arbitration proceedings under this clause. The Arbitrator shall have the power to extend with the consent of the Purchaser and the Contractor the time for making a publishing the award. The venue of Arbitration shall be the place as the Purchaser. In his absolute discretion may determine. Work under the contract shall if reasonably possible, continue during Arbitration proceedings.

16. COUNTER TERMS AND CONDITIONS OF SUPPLIERS :

Where Counter Terms and Conditions/printed or cyclostyled conditions have been offered by the Supplier, the same shall not be deemed to have been accepted by the Purchaser, unless specific written acceptance thereof is obtained.

17. SECURITY FOR PURCHASER'S MATERIAL(S) :

Successful Tenderer will have to furnish in the form of a Bank Guarantee or any other form as called for by the Purchaser towards adequate security for the materials/property by the Purchaser for the due execution of the Contract.