

AGREEMENT FOR TEAMING AND JOINT WORKING
FOR
DESIGN and DEVELOPMENT OF
Battery Charging System of 4.5 kW capacity

THIS AGREEMENT FOR TEAMING FOR THE DESIGN and DEVELOPMENT OF SKD/CKD KITS/SUB-ASSEMBLY OF Battery Charging System of 4.5kW capacity IS MADE ON THIS MONDAY, THE 31ST OF December, 2018.

Between,

(I) **GENERAL AUTO ELECTRIC CORPORATION**, a company incorporated under Indian companies Act 1956/a registered firm having its registered office at Unit No.:D207, ANSA Industrial Estate, Saki vihar Road, SAKI-NAKA, Andheri-East, Mumbai - 400072 hereinafter called as GAEC as party if the FIRST PART

And

(II). **Sardar Patel Institute Of Technology, (SPIT)**, an AICTE recognized college having address Munshi Nagar, Andheri (west), Mumbai - 400058, herein after called as SPIT as the party of the SECOND PART.

GAEC is a company of over 50 years and is an established manufacturer and supplier of many RDSO approved products to Indian Railways, while SPIT is an established institute spread over a campus of 47 acres and is affiliated to Mumbai University. It imparts various degree courses in Engineering and also certification courses. SPIT aspires to be one of the premier R&D organization in the academic world. It also involved in Research and Development in the area of Embedded systems, VLSI design, Power Electronics, Software Technology and related areas of Computer Science. Its focus is to help create cutting edge Technologies and offer advanced training for students, Government and Industry.

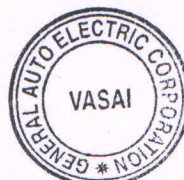
GAEC and SPIT felt that their collective expertise and teaming together can help explore new business avenues for the mutual benefit of both entities. Accordingly, GAEC has approached SPIT for the teaming for the design and development of **Battery Charging System - 4.5kW** for the Railway coaches, meant for its use in Indian Railways, hereinafter called the RBC or Product.

Alliance Objective

The scope of the MoU, the roles and responsibilities of the parties of the MoU are given below

1. GAEC and SPIT will engage mutual cooperation in Research and Development primarily in the field of Embedded Systems, Instrumentation & automation, Power Electronics, Industrial Electronics, Communication and Computing.
2. GAEC agrees to offer internship towards the student community of S.P.I.T. that is mutually beneficial.

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AGREEMENT FOR TRAINING AND JOINT WORKING

FOR

RESEARCH AND DEVELOPMENT OF

Energy Storage System - 4.5 MW capacity

1. The undersigned parties have agreed to enter into a joint working arrangement for the purpose of conducting research and development work on the Energy Storage System - 4.5 MW capacity project.

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9. The undersigned parties have agreed to enter into a joint working arrangement for the purpose of conducting research and development work on the Energy Storage System - 4.5 MW capacity project.



3. Research and new product development activities and joint research projects to be undertaken, funding for which will be provided by GAEC, SPIT will offer infrastructure, research human resource and laboratory facilities whenever necessary for a prescribed limited period.

Current Project Statement

GAEC is currently looking for the development of a Battery Charging Systems compatible with Railway's requirements and specifications. The present work is titled as "Design, implementation and testing of a DC-DC converter for ancillaries and charging battery." The proposed DC-DC converter is air cooled/naturally cooled, high conversion efficiency, safety, protection, temp, shock and vibration, as per standards (IEC/EN;UIC/AAR; and IS). This converter shall have output short circuit, over temperature, over and under voltage protection. Detail specification is annexed in **Annexure-1**.

In this context through this MOU, SPIT will develop the system within a span of 4-months. The hardware cost is provided by GAEC. SPIT project team shall build the digital control system around the Texas Instruments IC: TMS320F28069. Initially, SPIT team shall be taking help of development board, but later they will make PCboard around this IC. The TOT transfer be the handover of relevant working software/firmware on the designed system with documentation on functional explanation of each piece code block-wise for future reference and modifications, if any.

The hardware material means Inverter Bridge assembly, driver board, HF Transformer, CTs, Test Load, etc. SPIT team shall not ask for any discrete components, however, GAEC will have to provide the reasonable cost of the making of the boards/PCB along-with the components. SPIT team shall purchase discrete components at their end, as and when required in the consultation with GAEC project -team and raise the necessary bill against the invoice submitted to GAEC.

PCB Art work design will be the job of SPIT team, this is in their scope of work. However, GAEC should bear PCB manufacturing cost for all of the proto-types. SPI team will handover all the necessary PCB design files during TOT for future modifications, if any.

Project Implementation Schedule and Commercials

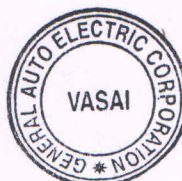
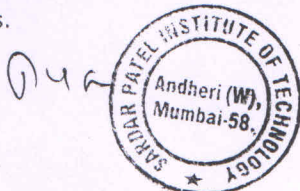
Specifications: As per Annexure-1

Control Strategy:

Full bridge Inverter with HF Isolation Transformer followed by a Schott-key Rectifier 200V/50A. Output is controlled with PSC. There are two control loops required. One is with output current and other is output voltage.

Control Implementation:

Phase shift Digital control with Texas Instrument UCD3138 64-pin programmable digital control IC OR any Texas DSP Delphino Microprocessor such as TI TMS320F28069. Switching frequency-50kHz, Transformer with ferrite core. Main Switching devices, Si Carbide MOSFET OR IGBTs.



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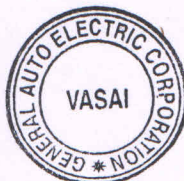
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Time Schedule:

This is a four months project having total three phases

(a) The First Phase is of one month and executes following task:

Design Phase (One Month)

Literature Survey, Computer Simulation, Overall System Design, Process flow

Design of schematic, PCB design, Power Hardware Design, Design of Magnetics, etc.

(b) The second phase would be of two- months required for:

Implementation (Two Months)

Ordering and assembling components and subsystems, hardware testing, programming firmware and fine-tuning the parameters for desired specifications

(c) The third stage is a Final stage of one month utilised for:

Testing and Handover (One Month)

Final testing, packaging and field testing. Preparation of report / design documents, etc. as per various test parameters. Handover of TOT documents.

Financials:

All the hardware cost of the prototype is born by GAEC. SPIT Project team will provide required Human resource and consultancy services till project completion.

The project implementation, HR and technology transfer cost is **Rs. 1.50 Lacs** only.

Payment Schedule:

- (a) Rs. 25,000 at the start of the projects, at the time of signing MOU
- (b) Rs. 25,000 after the completion of first step of two months
- (c) Rs. 50,000, after the completion of step-3 of two months
- (d) Rs. 50,000 after field trial and handing over the TOT documents etc.

SPIT Project Team:**Principal Investigator:**

Dr. Rajendra R. Sawant, Professor,

Department of Elect. and Telecommunication Engg.

Sardar Patel Institute of Technology,

Munshi Nagar, Bhavans Campus, Andheri (W), Mumbai-58.

022-26708520/2628 7250 (Ext: 390).

Mob: 9920247002

Email: rajendra.sawant@spit.ac.in, rrs1902@gmail.com

Co- Investigators:

(1) **Prof. Govind Haldankar,**

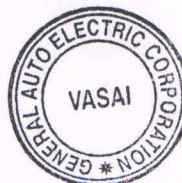
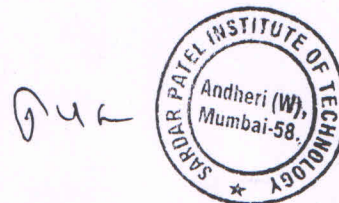
Asst Professor, Deptt. of Electronics Engg.

SPIT, Mumbai

(2) **Dr. Y S Rao,**

Vice Principal and Professor,

SPIT Mumbai



Signature

GAEC PROJECT TEAM:

Mr. Vijay Patel

Technical Advisor,

General Auto Electric Corporation,

Plot no. 30, Sector-I, Vasai Taluka Industrial Estate,

Gavraipada, Vasai Road (East), Dist.: Palghar - 401208.

Contact: 9820189462 E-mail: vijaypatel@gaec.in

Mr. Nehal Gandhi

Managing Partner,

General Auto Electric Corporation,

Plot no. 30, Sector-I, Vasai Taluka Industrial Estate,

Gavraipada, Vasai Road (East), Dist.: Palghar - 401208.

Contact: 9820132719 E-mail: nehalgandhi@gaec.in

Mutual Obligation

1. This MoU may be terminated by either party through a notice of one month. Either party may terminate this MoU if either of the parties is frustrated by reasons beyond its control from going ahead with the implementation of the provision of this MoU.
2. There shall be no liability on the part of any party to the other arising from the termination of this MoU.
3. This agreement may not be amended without the prior written consent of both the parties.
4. Neither party shall issue any press release, public announcement or other such disclosure concerning this agreement without the other party's consent as to such release or announcement.
5. SPIT will sign a Non-Disclosure Agreement (NDA) necessitated to protect IPR and essential information safeguards from both sides.
6. SPIT team shall be free to employ external consultant on paid basis, if required, in specific circumstances to meet the strict time-line for project completion without violating NDA document terms.
7. Intellectual Property Rights: IPR titles or ownership of any products, proprietary information or technology tools, processes, utilities, and methodology including any GAEC proprietary products or components thereof used hereunder or development of any deliverables and all new ideas, inventions, innovations, or developments conceived, development or made by GAEC hereunder will not be transferred from GAEC to the Institute on account of use of the same as part of any work under this MoU and shall always remain with GAEC.

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Summary

GAEC recognizes the significance of **SPIT** initiative to be the leader in the field of Education in Electronics, Communication and Computer Engineering and academia in the country. **GAEC** proposes to provide an opportunity to the **SPIT** faculty and students to work on live projects and learn the necessary skill-set essential as per the new technological trends in the country.

This Memorandum of Understanding is intended to express the broad understanding of the parties regarding their working with each other to the extent possible for their mutual benefit.

In written whereof both parties put their hard seal on the day, month and year herein mentioned.

Date: December 31, 2018

Principal,

Sardar Patel Institute of Technology,

Bhavan's Campus, Munshi Nagar,
Andheri (West), Mumbai-58.

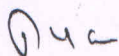
E-mail: principal@spit.ac.in

Telephone: (022) 26708520 Ext:
305

Managing Partner,

General Auto Electric Corporation,

D/207, Ansa Industrial Estate,
Sakivihar Road, Sakinaka,
Andheri (West), Mumbai-72,

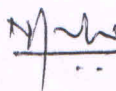


Signed By

Mrs. Dr. Prachi Gharpure

For SPIT, Mumbai

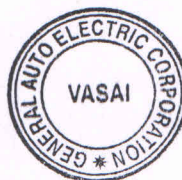




Signed By

Mr. Nehal Gandhi

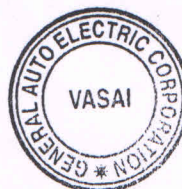
For GAEC, Mumbai



Annexure-1: Specifications

Product:	Battery Charger
Charger Type:	Constant Voltage with Current Limit
Rating:	135 V / 35 Amps.
Input: DC at 350V	475 V DC to 560V DC, 5 % ripple
operating Temp.:	0 to +55 °C
Cooling:	Natural cooling
Output Voltage:	110 V to 135 V settable via keypad
Output Current:	Total current : 35 Amps Battery current : settable from 10 Amps - 20 Amps
Load current:	15 Amp
Output Ripple:	2 % rms @ 122 V
Output Regulation:	$\pm 2\%$ @ 122 V for 10 % - 100 % Load
Efficiency:	$\geq 85\%$ at half load & $\geq 92\%$ at full load for 475 V to 550 V DC
Protections:	output over voltage Trip @ 135 V output short circuit protection Constant current mode after 35 Amps. Reverse Battery Protection Thermal Trip for Transformer Thermal Trip for Power Devices Charger shall work on 35 % Load when external safety signal turns ON
Front Panel Control:	ON - OFF switch, Fault Reset push button
Front Panel indications:	Battery Charging Indication Output Fuse Fail Indication Reverse Polarity Indication Earth Fault Indication Push Button for Fault Reset
Interface module:	Detachable - should work on serial protocol
LCD & Keypad :	LCD Display for parameter setting Fault diagnosis of input under / over voltage output short circuit reverse polarity Thermal shutdown output over voltage RTC setting & other parameter setting via key pad command for Data Down load

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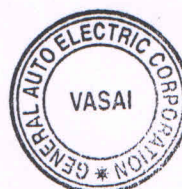
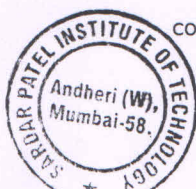


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USB interface:

for Fault Data download with Time: 500 records minimum
Date & Time of Fault start and end, Fault value must be recorded

Other Tests:**Insulation resistance Test**

HV Test - 1500 V AC rms for 1 minute

Surge Test - as per IEC60571

acoustic noise measurement Test

Acoustic Noise Measurement: The sound pressure level shall be measured in order to ensure that it is not exceeding the limit value of 60 dB (A) at a distance of 0.5 meter away from the equipment in all the directions. Tests shall be performed at no load, 50% load and full load; however, the manufacturer shall endeavor to reduce the noise level below 60 dB (A).

in the IEC 61000 for the following:-

- i. RFI RADIATED TEST: as per IEC 61000 - 4 - 3
- ii. RFI CONDUCTED TEST: as per IEC 61000 - 4 - 6
- iii. ELECTRICAL FAST TRANSIENTS TEST: as per IEC 61000 - 4 - 4
- iv. POWER FREQUENCY MAGNETIC FIELD: as per IEC 61000 - 4 - 8

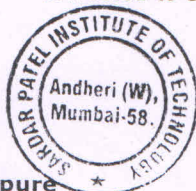
HF Transformer:

Natural cooled, with H class Transformer .
Temperature of Transformers shall not exceed 100°C when corrected to 55degree

Dr. Prachi

Mrs. Dr. Prachi Gharpure

For SPIT, Mumbai



Mr. Nehal

Mr. Nehal Gandhi

For GAEC, Mumbai

