

Reference No:

TEQIP-II/2016/GJ1G04/Shopping/1276/169

Date of Issue:

25/04/2016

Subject:

Electrical Machines

Purchaser:

Government Engineering College, Rajkot
 Government Engineering College, Mavadi-Kankot
 Road, Near Hanuman Temple, Rajkot-360 005
 GUJARAT

Supplier Name: Protection Systems (India), Bangalore

With reference to our correspondence, Government Engineering College, Rajkot is pleased to award this detailed Purchase Order to Protection Systems (India), Bangalore for supply of items as per the details given below at a total cost of 12,38,500.00 (Twelve lacs Thirty Eight thousand Five hundred Rupees):

Sr. No	Item Name	Quantity	Unit Cost (Rs.)	Total Cost (Rs.)	Delivery Period
1	1-Phase Transformer's Test Unit	1	1,33,500.00	1,33,500.00	30
2	3-Phase Transformer's Test Unit	1	1,36,600.00	1,36,600.00	30
3	Single Phase Induction Motor	1	88,200.00	88,200.00	30
4	Three Phase Squirrel Cage Induction Motor	1	1,32,000.00	1,32,000.00	30
5	Three Phase Slip Ring Induction Motor	1	1,45,300.00	1,45,300.00	30
6	D.C. Series Motor	1	1,30,000.00	1,30,000.00	30
7	D.C. Shunt Motor coupled to D.C. Shunt Generator	1	2,30,900.00	2,30,900.00	30
8	D.C. Shunt Motor coupled with Non-Salient Pole Alternator	1	2,42,000.00	2,42,000.00	30

Total price (without taxes)	:	Rs. 12,38,500.00
Total applicable taxes	:	14.5 % VAT/CST
Total price (with taxes)	:	Rs. 14,18,083.00

Delivery	:	Government Engineering College, Rajkot Testing/Installation
Clause (if any)	:	Testing and Installation required
Training Clause (if any)	:	Training Required for faculty & Staff
Technical Specifications	:	As per Annexure – 1
Delivery Period	:	30 days from date of issue of confirmed purchase order or as early as possible. Party has to do installation and testing .
Warranty	:	24 Months
Special requirement	:	(i) The Vendor will have to submit 2.5 % of the total amount as performance bank guarantee for warranty period. (ii) Vendor has to submit manufacture warranty certificate for each item under the contract. (iii) For any kind of Disputes, Jurisdiction Centre is Rajkot. (iv) Penalty Clause: <ul style="list-style-type: none">• Penalty will apply from the next day of completion of delivery cum installation period.• Penalty charge 0.01% per day of contract value.• Purchaser reserved right to cancel the order/contract in case of any delay in delivery/inspection/installation and / or any technical or quality standard violation as mentioned in inquiry specification. (v) Information brochures/product catalogue, if any must be accompanied with the quotation clearly indicating the model quoted for.
Payment Terms	:	Delivery and Installation - 0% of total cost Satisfactory Acceptance - 100% of total cost

For

Government Engineering College, Rajkot

(Authorized Signatory)

Name & Designation

[Handwritten Signature]

*FRD
(Electrician)*

Verified and found o.k
o/c. *Rajendra*
(R.A. Mehta)

Accepted by

Signature

[Handwritten Signature]
25/4/16

Date

Address

PRINCIPAL,
GOVT. ENGINEERING COLLEGE,
RAJKOT.

Annexure I

Generic Specifications

Name of Package: Electrical Machines Lab.

Sr. No.	Specifications
1.	<p data-bbox="327 481 869 526"><u>I-PH. TRANSFORMER'S TEST UNIT:</u></p> <p data-bbox="327 616 1436 694"><i>List of Experiments</i> (The equipment set-up must be practiced to do the following experiments):</p> <ol data-bbox="327 728 1436 1019" style="list-style-type: none">1. Sumpner's test on single phase transformer.2. Open circuit and short circuit test to determine regulation, efficiency and equivalent circuit of single phase transformer.3. Parallel operation of two similar transformers.4. Parallel operation of two dissimilar transformers.5. Open delta or V-V connection of two single phase transformers.6. Scott connection with two single phase transformers. <p data-bbox="327 1086 510 1120"><i>Specifications:</i></p> <ol data-bbox="327 1153 1436 1780" style="list-style-type: none">1. Similar transformers: 230V/230V, 1kVA, with tapings: 50% on Primary and 50%, 86.6%, 100% on secondary— 2no's (National / International repute make).2. Dissimilar transformer: 230V/230V, 2kVA, with tapings 50%, 86.6%, 100% – 1 no. (National / International repute make).3. Power measurement: Through power analysers – 3no's (National / International repute make).4. Meters: As per requirement (National / International repute make).5. All connections should be brought out by BT1-30.6. MCB's, Contactors OLR (National / International repute make) should be built-in.7. Necessary loads should be provided.8. Auxiliary supply must be through EMI filter.9. RS-485 facility should be provided with necessary software.10. The complete equipment should be made of M.S. (18g) galvanized sheet duly powder coated. The front control sheet should also be galvanized (16g) sheet, powder coated, screen printed and finally water proof clear lacquer coated. <p data-bbox="327 1836 406 1870">NOTE:</p>

	<ol style="list-style-type: none"> 1) Supplier must demonstrate all the 6 experiments at the time of installation. 2) Make and quality of the equipment will be checked before clearing the equipment.
2.	<p><u>3-PHASE TRANSFORMER'S TEST UNIT:</u></p> <p><i>List of Experiments</i> (The equipment set-up must be practiced to do the following experiments):</p> <ol style="list-style-type: none"> 1. Operation of three-phase transformer with various connections like; Delta-Delta, Delta-Star, Star-Delta, Star-Star, Zigzag-Delta, Zigzag-Star etc. 2. Polarity test of 3-Ph Transformer. 3. Open circuit and short circuit test to determine the regulation and efficiency of 3-Ph Transformer. 4. Direct load test of 3-Ph Transformer. <p><i>Specifications:</i></p> <ol style="list-style-type: none"> 1. Transformer: 3-Phase/440V/230V/2KVA – 1 no's 2. Power Analyser: 3 Phase (National / International repute make). 3. Ammeter: 3 ½ digit (National / International repute make). 4. Voltmeter: 3 ½ digit (National / International repute make). 5. Autotransformer: 3Ø, 440V/10A (National / International repute make). 6. Resistive load: 3Ø, 440V/10A, 10 steps (with fan cooling). 7. Facility: RS-485 with necessary software and USB Port. 8. The panel should be Zinc plated, Powder coated, Screen printed and finally coated with washable clear coat. 9. BTI-15/30 connectors should be fixed to take the connections out for ease of operation. 10. MCB, OLR, Fuses must be built-in for protections. <p>NOTE:</p> <ol style="list-style-type: none"> 1) Supplier must demonstrate all the 4 experiments at the time of installation. 2) Make and quality of the equipment will be checked before clearing the equipment.
3.	<p><u>SINGLE PHASE INDUCTION MOTOR:</u></p> <p><i>List of Experiments</i> (The equipment set-up must be practiced to do the following experiments):</p> <ol style="list-style-type: none"> 1. No-load and Blocked-Rotor test to plot circle diagram of 1-Phase Induction motor

- performance evaluation.
- 2. Load test on 1-Phase Induction motor – performance evaluation:
 - Torque vs Speed
 - BHP vs Efficiency
 - BHP vs Power factor
 - Slip vs BHP.
- 3. Determination of equivalent circuit diagram of a 1 phase Induction motor and obtain its performance evaluation.

Specifications:

1. **Motor Rating:** 2 H.P. (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
2. **Power Supply:** 1 Phase, 230V AC.
3. **RPM:** 1440.
4. **Power analyser:** DSP based (National/International repute make).
5. **RPM Meter:** 4 digit (National/International repute make).
6. Mechanical loading must be on anti-vibration pads and movement through bearings.
7. Software with RS485-USB converter should be provided.
8. Necessary protection devices should be from the National/International repute make only.
9. The panel should be made of 18g CR sheet duly Zinc plated and powder coated. Control panel front should be 16g zinc plated, powder coated, screen printed sheet with water proof clear lacquer coating.
10. Terminals must be brought out using BT1 15/30 connectors.
11. Built-in DOL starter should be provided for motor operation.
12. Proximity sensor should be provided for speed measurement.
13. Auxiliary supply must be through EMI Filters for all meters.

NOTE:

1. Supplier must demonstrate all the 3 experiments at the time of installation.
2. Make and quality of the equipment will be checked before clearing the equipment.

4. THREE PHASE SQUIRREL CAGE INDUCTION MOTOR:

List of Experiments (The equipment set-up must be practiced to do the following experiments):

1. Circle diagram of 3-Phase Squirrel Cage Induction motor – performance evaluation.

2. Load test on 3-Phase Squirrel Cage Induction motor – performance evaluation:
 - Torque vs Speed
 - BHP vs Efficiency
 - BHP vs Power factor
 - Slip vs BHP.
3. Determination of equivalent circuit diagram of 3 phase Squirrel Cage Induction motor and obtain its performance evaluation.

Specifications:

1. **Rating of the motor:** 3HP, 415VAC, 1440RPM (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
2. **Ammeter:** 3 ½ digit (National / International repute make).
3. **Voltmeter:** 3 ½ digit (National / International repute make).
4. **Power Analyser:** DSP based (National / International repute make).
5. **RPM meter:** 4 digit display (National / International repute make).
6. The panel should be made of 18g Sheet metal with Zinc plating and powder coated. The front panel should be screen printed and finally water proof clear lacquer coated.
7. Terminals should be brought out through BTI 15/30 connectors.
8. Motor should be mounted on powder coated 5mm thick MS sheet with anti-vibration mounts to avoid any vibrations.
9. Friction type loading should have two scales and pulley. The movement must be through National/International repute make bearings.
10. Software with RS485-USB converter should be provided. National / International repute make MCB, OLR, HRC Fuses should be provided.

NOTE:

- 1) Supplier must demonstrate all the 3 experiments at the time of installation.
- 2) Make and quality of the equipment will be checked before clearing the equipment.

5. THREE PHASE SLIP RING INDUCTION MOTOR:

List of Experiments (The equipment set-up must be practiced to do the following experiments):

1. Load test on 3 phase Slip ring induction motor – performance evaluation:
 - Torque vs Speed
 - BHP vs Efficiency
 - Slip vs BHP

	<ul style="list-style-type: none"> • BHP vs Power factor. <p>2. Speed control of slip ring induction motor by:</p> <ul style="list-style-type: none"> • Stator voltage control • Rotor resistance control. <p>Specifications:</p> <ol style="list-style-type: none"> 1. Motor rating: 2.4KW, 1440rpm, 3ϕ (Make: Kirloskar / ABB / Crompton Greaves or Equivalent). 2. Ammeter: 3 ½ digit (National/International reputed make). 3. Voltmeter: 3 ½ digit (National/International reputed make). 4. Power Analyser: DSP based (National/International reputed make). 5. RPM meter: 4 digit (National/International reputed make). 6. Power analyser with RS 485_USB converter and necessary software should also be provided. 7. Built-in DOL should be provided for motor operation. 8. Auxiliary supply to all the meters should be through EMI filters. 9. Motor should be mounted on 5mm M.S. inverted 'U' powder coated sheet with anti vibration mounts. 10. Safety should be taken care using MCB's, OLR, HRC fuses (National/International reputed make) and glass fuses for meters. 11. The panel should be made of 18 gauge Zinc plated and powder coated sheet. Front plate of the panel (16g) will also be Zinc plated, powder coated, screen printed and finally clear lacquer coated. 12. All the necessary terminals are brought out through BTI 15/30 connectors for external connections. 13. <p>NOTE:</p> <ol style="list-style-type: none"> 1) Supplier must demonstrate all the 2 experiments at the time of installation. 2) Make and quality of the equipment will be checked before clearing the equipment.
6.	<p><u>D.C SERIES MOTOR:</u></p> <p>List of Experiments (The equipment set-up must be practiced to do the following experiments):</p> <ol style="list-style-type: none"> 1. Load test on DC Series motor. 2. Pre-determination of Speed-Torque, BHP-efficiency characteristics of DC Series motor. 3. Speed Control of DC Series motor by:

- BHP vs Power factor.
2. Speed control of slip ring induction motor by:
 - Stator voltage control
 - Rotor resistance control.

Specifications:

1. **Motor rating:** 2.4KW, 1440rpm, 3Ø (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
2. **Ammeter:** 3 ½ digit (National/International repute make).
3. **Voltmeter:** 3 ½ digit (National/International repute make).
4. **Power Analyser:** DSP based (National/International repute make).
5. **RPM meter:** 4 digit (National/International repute make).
6. Power analyser with RS 485_USB converter and necessary software should also be provided.
7. Built-in DOL should be provided for motor operation.
8. Auxiliary supply to all the meters should be through EMI filters.
9. Motor should be mounted on 5mm M.S. inverted 'U' powder coated sheet with anti-vibration mounts.
10. Safety should be taken care using MCB's, OLR, HRC fuses (National/International repute make) and glass fuses for meters.
11. The panel should be made of 18 gauge Zinc plated and powder coated sheet. Front plate of the panel (16g) will also be Zinc plated, powder coated, screen printed and finally clear lacquer coated.
12. All the necessary terminals are brought out through BTI 15/30 connectors for external connections.
- 13.

NOTE:

- 1) Supplier must demonstrate all the 2 experiments at the time of installation.
- 2) Make and quality of the equipment will be checked before clearing the equipment.

6. **D.C SERIES MOTOR:**

List of Experiments (The equipment set-up must be practiced to do the following experiments):

1. Load test on DC Series motor.
2. Pre-determination of Speed-Torque, BHP-efficiency characteristics of DC Series motor.
3. Speed Control of DC Series motor by:

- Flux Control
- Armature Resistance Control.

Specifications:

1. **D.C. Series motor:** 3.7 KW/1500rpm/230V (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
2. **Ammeter:** 3 ½ digit (National/International repute make)
3. **Voltmeter:** 3 ½ digit (National/International repute make)
4. **RPM meter:** 4 digit (National/International repute make)
5. Screen printed (M.S) panel box with washable clear coating should be there.
6. Built-in D.C. power supply (28A DC) must be provided.
7. Built-in variac for armature supply must be provided.
8. Built-in Rheostat must be provided.
9. Mechanical loading with heavy duty bearing and anti-vibration pads must be provided.
10. Protection devices of National/International repute make like MCB, OLR, and Fuses should be built-in.
11. All terminals must be brought out to easy operation.

NOTE:

- 1) Supplier must demonstrate all the 3 experiments at the time of installation.
- 2) Make and quality of the equipment will be checked before clearing the equipment.

7. D.C. SHUNT MOTOR COUPLED TO D.C. SHUNT GENERATOR:

List of Experiments (The equipment set-up must be practiced to do the following experiments):

1. Load characteristics of DC Shunt Generator.
2. Load test on DC Shunt motor.
3. Hopkinson's test.
4. Swinburne's test.
5. Speed control of DC Shunt Motor by:
 - Armature voltage control
 - Flux control.

Specifications:

1. **D.C.Shunt Motor:** 3.7KW (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).

2. **D.C. Shunt Generator:** 3.5KW (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
3. Speed: 1500 RPM.
4. Ammeter: 3 ½ digit (National/International repute make).
5. Voltmeter: 3 ½ digit (National/International repute make).
6. RPM meter: 4 digit (National/International repute make).
7. It must have internal variac for armature and field.
8. Screen printed panel with washable clear coat.
9. Motor-generator must be mounted on anti-vibration mounts to avoid vibration.
10. It must have necessary built in DC Supply.
11. Necessary loads must be provided.
12. Motors should be coupled using guarded joy-coupling.

NOTE:

- 1) Supplier must demonstrate all the 5 experiments at the time of installation.
- 2) Make and quality of the equipment will be checked before clearing the equipment.

8. **D.C. SHUNT MOTOR COUPLED WITH NON-SALIENT POLE ALTERNATOR:**

List of Experiments (The equipment set-up must be practiced to do the following experiments):

1. Direct load test of an Alternator.
2. Regulation of Alternator by EMF method.
3. Regulation of Alternator by MMF method.
4. Regulation of Alternator by ZPF method.
5. Sequence impedance of cylindrical rotor alternator.

Specifications:

1. **D.C. Shunt motor:** 5KW/1500rpm/220V DC (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
2. **Non-Salient pole alternator:** 5kVA/1500rpm/430V AC (Make: Kirloskar / ABB / Crompton Greaves or Equivalent).
3. **Ammeter:** 3 ½ digit (National/International repute make).
4. **Voltmeter:** 3 ½ digit (National/International repute make).
5. **Power Analyser:** 3Ø (National/International repute make).
6. **RPM meter:** 4 digit display (National/International repute make).

7. The panel front must be made of 16g Zinc coated CR Sheet powder coated, screen printed and finally coated with washable clear coat.
8. Assembly must be mounted on M.S powder coated inverted 'U' channel with anti-vibration mounts.
9. Built-in D.C. power supply (28A DC) must be provided.
10. Power Analyser should be with RS-485 facility.
11. RS 485-USB converter with necessary software should be provided.
12. Necessary loads must be provided.
13. MCB, OLR, Fuse should be built-in for protection.
14. Assembly should be done using love-joy coupling with guard.

NOTE:

- 1) Supplier must demonstrate all the 5 experiments at the time of installation.
- 2) Make and quality of the equipment will be checked before clearing the equipment.