ATTOCK PETROLEUM LIMITED

DETAILED ENGINEERING SERVICES FOR THE DEVELOPMENT APL PORT QASIM BULK OIL TERMINAL

PROCUREMENT PACKAGE FOR DIESEL GENERATORS & ALLIED

Submitted By:

Zishan Engineers (Pvt.) Ltd.

An ISO 9001-2008, 14001-2004 & 18001-2007 certified company

ZEL: 47/F, Block 6, PECHS, Karachi-Pakistan, Tel: +92-21-34393045-48, & 34310151-54, Fax: +92-21-34533430 & 34310156
E-mail: contact@zishanengineers.com, Website: www.zishanengineers.com

MATERIAL REQUISITION

Zishan Engineers (Pvt.) Ltd.
An ISO 9001-2008 certified company,
47/F, Block 6, PECHS, Karachi-Pakistan
Tel: (92-21) 34393045-48 & 34310151-54
Fax: (92-21) 34533430 & 34310156
E-mail : contact@zishanengineers.com,
Web : www.zishanengineers.com

Document No.	151-6-MRE-001
Revision	B
Date	07-03-2019
Total Pages (inc front cover)	3

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ATTOCK PETROLEUM LIMITED

PORT QASIM BULK OIL TERMINAL PROJECT

MATERIAL REQUISITION FOR DIESEL GENERATORS & ALLIED PACKAGE

ISSUED FOR APPROVAL

Rev.	Date	Description	Prepared By	Checked By	Approved By
B	07-03-2019	Issued for Approval	MAK	MMM	NAK
A	22-01-2019	Issued for Tender	MAK	MMM	NAK

MATERIAL REQUISITION FOR DIESEL GENERATORS & ALLIED PACKAGE

CLIENT ATTOCK PETROLEUM LIMITED

PROJECT PORT QASIM BULK OIL TERMINAL PROJECT

ITEM MATERIAL REQUISITION FOR DIESEL GENERATORS & ALLIED PACKAGE

ITEM	MATERIAL DESIGNATION	QTY.	UNIT	RATE / UNIT SUPPLY		LOADING, TRANSPORTATION UNLOADING COST, INCLUDING INSTALLATION & COMMISSIONING TO APL PORT QASIM BULK OIL TERMINAL ORIGIN SHOULD BE EU/NORTH AMERICA/JAPNESE (Pak.Rs.)	TOTAL PRICE (PAK.Rs)		NOTES
				(C&F KARACHI PORT) INCLUDING INSURANCE & INSPECTION ETC. (USD)	(EX-WORKS BASIS FOR LOCAL MANUFACTURERS) (Pak Rs.)		IMPORTED ITEMS (USD + Pak Rs.)	LOCALLY MANUFACTURED ITEMS (Pak Rs.)	
		A		B1	B2	C	D=AxB1 (USD)+C (Pak Rs.)	D=AxB2 (Pak Rs.)+C (Pak Rs.)	
	THE DIESEL ENGINE GENERATOR PACKAGE SHALL COMPLY WITH THE FOLLOWING SPECIFICATIONS AND DATASHEETS ATTACHED. **GENERAL PURCHASE CONDITIONS** (DOC. NO. 151-6-GCC-009) **INSTRUCTIONS TO BIDDERS** (DOC. NO. 151-6-ITB-009) **DATA SHEETS & SPECIFICATIONS** 151-6-DSE-002 151-6-DSE-004 151-6-SPE-004 **DRAWING** DRAWING NO. 151-6-ELS-001 (VENDOR TO FURNISH EXPLICIT ITEMIZED RATES FOR THE FOLLOWING LISTED ITEMS ALONG WITH CONSOLIDATED PACKAGE COST) ACCPETABLE BRANDS FOR THE BELOW MENTIONED GENSETS ARE: a) ALLIED CATERPILLAR b) ORIENT ENERGY SYSTEMS (PVT.) LTD. c) VPL LTD. d) SYNERGY CORPORATION e) S.M. JAFFER								INSPECTION OF SUPPLIED GENERATOR SETS, REVIEW OF CERTIFICATES, DIMENSIONAL, QUALITY, QUANTITY AND PACKING LIST CHECK SHALL BE WITNESSED BY THE 3RD PARTY INSPECTORS FROM A REPUTED INSPECTION COMPANY HIRED BY THE OWNER, SUPPLIER SHALL SUBMIT DETAILED MANUFACTURING SCHEDULE, QUALITY CONTROL PLAN AND INSPECTION AND TEST PROCEDURES ALONGWITH THE BID. FINAL ACCEPTANCE OF MATERIAL / EQUIPMENT WILL BE SUBJECT TO APPROVAL FROM THE 3RD PARTY INSPECTION COMPANY AND THE OWNER REPRESENTATIVE. THE DG SET ACCESSORIES IN GENERAL AGREED BY THE BIDDER TO SUPPLY IN THE BID IF MENTIONED ONLY FOR DG SET G-01 SHALL ALSO BE APPLICABLE TO THE SUPPLY OF DG SET G-03 BY THE BIDDER. BIDDER SHALL STRICTLY BOUND TO SUBMIT FILLED COPY OF DATASHEET ALONG WITH BID OTHERWISE IT WILL NOT BE ACCEPTABLE.
1.0	**DIESEL GENERATOR SET (G-01)**								
1.1	DIESEL ENGINE DRIVEN GENSET, G-01, 1000 kVA@0.8 PF , 400V, 3-PHASE, 50HZ, PRIME RATED, COMPLETE WITH ALL SYSTEM COMPONENTS INCLUDING BUT NOT LIMITED TO DIESEL ENGINE, ALTERNATOR, FUEL SYSTEM, EXHAUST SYSTEM, COOLING SYSTEM, STARTING SYSTEM, EARTHING SYSTEM, ALL SAFETY, CONTROL AND MONITORING INSTRUMENTATION,DUCTING FOR HEAT EXCHAGER, EXHAUST PIPE FROM GENERATOR TO OUTSIDE THE BUILDING, GENERATOR CONTROL PANEL WITH SWITCHGEAR, STANDARD PROTECTION RELAYS, ELECTRICAL AND MECHANICAL SAFETY INTERLOCKS, ALL PANEL MOUNTED INSTRUMENTS, PROTECTIONS ETC. COMPLETE IN ALL RESPECTS AS PER SPECIFICATIONS 151-6-SPE-004 AND DATA SHEET 151-6-DSE-002.	1	SET						

MATERIAL REQUISITION FOR DIESEL GENERATORS & ALLIED PACKAGE

CLIENT ATTOCK PETROLEUM LIMITED

PROJECT PORT QASIM BULK OIL TERMINAL PROJECT

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		A		B1	B2	C	D=AxB1 (USD)+C (Pak Rs.)	D=AxB2 (Pak Rs.)+C (Pak Rs.)	
	NOTE: THE ABOVE SHOULD INCLUDE, AMF AND ATS RELATED INTERLOCKS AND PROTECTIONS (151-6-ELS-001), STARTING SYSTEM CONTROL, PROVISION OF SYNCHRONISING SYSTEM FOR FUTURE INCOMING GENRATOR. COMPLETE IN ALL RESPECTS AS PER SPECIFICATIONS 151-6-SPE-004 AND DATA SHEET 151-6-DSE-002.								
1.3	COMMISSIONING / START-UP TOOLS & SPARES PARTS (PRICED LIST TO BE FURNISHED)	1	LOT						
1.4	2-YEARS OPERATION SPARE PARTS (PRICE LIST TO BE FURNISHED)	1	LOT						
2.0	**DIESEL GENERATOR SET (G-03)**								
2.1	DIESEL ENGINE DRIVEN GENSET, G-03, 120 kVA@0.8 PF , 400V, 3-PHASE, 50HZ, PRIME RATED, COMPLETE WITH ALL SYSTEM COMPONENTS INCLUDING BUT NOT LIMITED TO DIESEL ENGINE, ALTERNATOR, FUEL SYSTEM, EXHAUST SYSTEM, COOLING SYSTEM, STARTING SYSTEM, EARTHING SYSTEM, ALL SAFETY, CONTROL AND MONITORING INSTRUMENTATION,DUCTING FOR HEAT EXCHAGER, EXHAUST PIPE FROM GENERATOR TO OUTSIDE THE BUILDING, GENERATOR CONTROL PANEL WITH SWITCHGEAR, STANDARD PROTECTION RELAYS, ELECTRICAL AND MECHANICAL SAFETY INTERLOCKS, ALL PANEL MOUNTED INSTRUMENTS, PROTECTIONS ETC. COMPLETE IN ALL RESPECTS AS PER SPECIFICATIONS 151-6-SPE-004 AND DATA SHEET 151-6-DSE-004.	1	SET						
	NOTE: THE ABOVE SHOULD INCLUDE, AMF AND ATS RELATED INTERLOCKS AND PROTECTIONS (151-6-ELS-001), STARTING SYSTEM CONTROL, PROVISION OF SYNCHRONISING SYSTEM FOR FUTURE INCOMING GENRATOR. COMPLETE IN ALL RESPECTS AS PER SPECIFICATIONS 151-6-SPE-004 AND DATA SHEET 151-6-DSE-004.								
2.3	COMMISSIONING / START-UP TOOLS & SPARES PARTS (PRICED LIST TO BE FURNISHED)	1	LOT						
2.4	2-YEARS OPERATION SPARE PARTS (PRICE LIST TO BE FURNISHED)	1	LOT						
					TOTAL (PAK.Rs)				

TOTAL IN WORDS PAK Rs : _____

SIGNATURE OF BIDDER WITH SEAL

ATTOCK PETROLEUM LIMITED

GENERAL TERM & CONDITIONS FOR SUPPLY OF EQUIPMENTS / MATERIALS

TABLE OF CONTENTS

1.0 SCOPE

This document covers general conditions governing the manufacture and supply of equipments for Port Qasim Terminal of M/s. **A**ttock **P**etroleum **L**imited **(APL)**. The terms mentioned here form integral part of the Purchase Order.

2.0 DEFINITIONS

2.1 Owner

Attock Petroleum **L**imited **(APL)**

7th & 8th Floor,
Attock House,
Morgah, Rawalpindi
Pakistan

2.2 Vendor

Means the company, firm or agency with whom has order been placed the supply of Equipments.

2.3 Bidder

A potential supplier of Equipment and material who has been invited to bid.

3.0 INSTRUCTIONS

This general specification for the supply of equipment and material apply to all procurement and shall be considered an integral part of the purchase order. These may be modified by particular conditions stipulated in the purchase order and/or through attached technical documents. Where requirements of the general specification deviates from the said particular conditions and/or purchase orders, later shall govern.

No deviation from the general specifications for the supply of equipment and material will be acceptable unless special exception is agreed and notified in writing to the manufacturers/suppliers by the Owner.

These general conditions shall supersede any conditions indicated by the manufacturer in his bid unless such conditions have been specifically included in the Purchase Orders.

4.0 APPLICABLE TECHNICAL DOCUMENTS

The applicable technical specifications, data sheets, respective codes, standards and general specifications enclosed to the purchase order, form integral part thereof. All the equipment supplied against such purchase orders shall strictly conform to the aforementioned technical documents.

5.0 LIMITS OF SUPPLY

The scope of supply shall include the manufacture and supply of equipment, fabrication, painting, testing of equipment and packing, all in accordance with the applicable drawings/specifications, Data Sheets and Standards. In case the equipment is to be assembled at site, the procedures and facilities for assembly, necessary spare parts needed at site and experts personnel for supervision during erection/commissioning (where required) is also included in the scope of supply.

When a purchase order includes two or more similar items the supplier shall ensure maximum interchange ability of components such as couplings, electric motors etc.

5.1 Spare Parts

Vendor shall guarantee the supply of spare parts for a minimum of 10 years. The vendor is required to provide complete spare part list accompanied by all sectional drawings and other documents needed for the identification of the spare parts. Price of spare parts for Two 02 years shall be quoted as per material requisition.

5.2 Lubricants

Vendor shall provide detailed list of lubricants, specifying the quantities and grades to be used for **"first fill"** and for subsequent operations.

5.3 Commissioning Spares

All the spares required for the successful commissioning of the equipment / material shall be supplied by the vendor and the priced list shall be submitted along with the bid.

6.0 TESTING & INSPECTION

Vendor shall carryout all tests on equipment as per international practices and those specified in the technical documents, attached to the purchase order. Testing procedure of Equipments shall be given in the technical documents attached to the purchase order. Where such procedures are not given, following test and checks shall be carried out

according to applicable codes and standards and relevant test certificates issued to the Owner.

- Performance Test of all equipment.
- Tests and inspection on electrical equipment as generally prescribed in industrial practices, codes standards etc.
- Hydrostatic test on all equipment operating under pressure/static head.
- Dimensional checks.

Material / Mill Test Certificates shall be submitted as per EN 10204/3.1 B.

It will be OWNER's right to have a 'Pre-inspection meeting' with the Vendor in order to discuss the Construction and/or test plans in details. They shall have free access to the premises of the manufacturer and their sub-supplier, and vendor shall ensure that all possible help and assistance is made available to such representative.

Inspectors of OWNER and/or those appointed by them, shall witness the tests required by the purchase order and/or by the specifications. Any waiver of witnessing the tests will be notified to vendor in writing only. Such waivers will not relieve the vendor of his liabilities.

Vendor shall carryout the inspections/tests required by the purchase order and/or attached specifications and inspection data sheets. Vendor shall notify OWNER in writing or by fax at least 30 days before the date established for the testing/inspection. However, the presence of OWNER inspectors and/or those appointed by them does not relieve the vendor of any of his responsibilities/liabilities.

The sub-vendor's inspection and test are the vendor's obligation and responsibility. However, OWNER reserves the right to carry out their own inspection at the sub-vendor's workshop and to witness the tests on such vendor.

Any or all tests/inspection may also be witnessed by official institutions.

Within 15 days of the final successful tests the Vendor must send to OWNER one original and 3 copies of all material and test certificates.

6.1 **Expediting**

Expeditors of OWNER will carry out the expediting of the order, by visiting or otherwise contacting the vendor. Vendor shall appoint a "Vendor's Co-ordinator"

responsible for giving complete and reliable information on the purchase order status. The information will include supply schedule, design and work progress, issuance and progress status of any sub-orders, critical sub-orders and the expected delivery date.

7.0 VENDOR'S TECHNICAL DOCUMENTS

Upon receipt of the purchase order, the vendor is required to furnish the following:

a) The Vendor shall furnish within one week, the schedule of manufacture and delivery program in two copies. The schedule shall indicate the time table of the activities including, manufacturing stages, assembly, testing and delivery of the equipment. Within 2 weeks of the receipt of purchase order the Vendor shall supply to OWNER, the fabrication specifications and drawings for its comments/approval and shall commence the fabrication work only after the receipt of comments/approval on such drawings/specifications. The Vendor shall also submit weekly progress reports indicating the manufacturing status report.

b) Vendor shall furnish within 3 weeks of the receipt of purchase order, 4 sets with one reproducible of each certified equipment mounting and dimensional drawings and equipment weight for the purpose of foundations/piping design.

c) The Vendor shall furnish, upon delivery:

   1) All drawings and specifications developed for the equipment in 4 copies and one reproducible.

   2) 4 copies of complete equipment data books which will include material mill test certificates, inspection certificates, radiographic reports, hydro-static test certificates etc.

   3) 4 copies of Installation, Operations and Maintenance Manuals.

d) In addition to the instructions provided in the technical specifications/data sheets, Vendor shall comply with the following requirements for Installations, Operations and Maintenance Manuals.

   1) The front cover, spine and inside page shall state the purchase order number and Vendor's reference number.

   2) The inside front page shall carry an index listing the contents of each section of the manual.

   3) Individual sections shall be complete and shall refer to equipment actually supplied.

4) Published data shall be included, including published data for bought-in items.

5) Devices requiring adjustment and settings shall be fully documented and settings listed.

6) A punch list of 'do's" and don'ts" shall be included.

7) Full details for installation and setting up shall be included.

8) Recommended test data shall be stated, covering initial and also regular testing.

9) Items requiring regular inspection, checking, testing and maintenance shall be listed and the time scale clearly indicated.

10) Important items shall be cross referenced to other parts of the manual as necessary.

8.0 PACKING & SHIPPING

8.1 General

Vendor shall ensure that all items of equipment shall be delivered in proper air/rail/road/sea worthy packing, (as applicable) and where special protection is required, Vendor shall so arrange accordingly. Packing shall be arranged by Vendor and cost to be included in the price of this purchase order. The Vendor shall be liable for any damage to the equipment caused by:

a) Bad or ineffective packing or deterioration/ corrosion as a result of incorrect or inadequate protection during transportation and storage not exceeding eighteen (18) months in total.

b) Corrosion as a result of the Vendor's failure to indicate storage recommendations.

c) Loading or unloading resulting from Vendor's failure to provide any or adequate instructions.

During packing Vendor shall ensure that:

1) A packing list is enclosed with all closed packages.

2) The packages are marked according to specifications.

3) Certificates of origin, where required are available.

8.2 Preparation for Delivery to Site

a) After final hydrostatic test, where applicable, the equipment shall be dried and cleaned thoroughly inside and outside to remove grease, loose scale, rust and dirt.

b) All finished surfaces and surfaces which are not protected by blind flanges shall be coated with rust preventive.

c) All flanges opening which are not provided with covers shall be protected by suitable steel plates.

d) Threaded openings shall be plugged.

e) For internal parts (where applicable) suitable supports shall be provided to avoid damage during shipment.

f) Bolts and nuts shall be coated with water proof lubricant.

g) Equipments shall be clearly identified by painting the order and item number in a conspicuous location on the packing.

h) Small parts which are to be delivered loose shall be bagged or boxed and marked with the purchase order and item number of the equipment.

i) Vessel fabricator shall take all necessary precautions in loading by blocking and bracing the vessel and furnishing all necessary material to prevent damages during transport.

j) Packing dimensions will be restricted by the inland transport facilities and passage limitations.

k) Marking Instructions:

- The packages shall carry marking on top and on three sides; an arrow shall indicate top of equipment.

- Name of OWNER and OWNER's mark shall be atleast at two positions on the case:

  (EQUIPMENT NAME)
  ATTOCK PETROLEUM LIMITED
  RAWALPINDI
  PAKISTAN
  letters minimum 75 mm high unless impracticable.

- At least two position on the case:

  Package number, part number and number of pieces and purchase order number, weight (Gross) and net weight.

- Insurance Policy No. Package stackable Yes/No.

- Warning marks (fragile, top, keep dry etc.).

All markings shall be in indelible ink/paint and easily readable.

8.3 **Shipping Papers**

The Vendor shall submit full shipping documents via airmail by registered post to the Owner, preferably in two separate registered covers. All shipping documents shall be airmailed within a week after the ship has sailed so as to reach the Owner in advance of the arrival of the ship. Responsibility for delay in the receipt of shipping documents shall rest with the Vendor, who shall pay all demurrage and port storage charges accruing as a result of late receipt of shipping documents.

The shipping documents shall be sent as follows:

	No. of Copies Required
1. Payment Invoice	4
2. Original B/L	2
3. Non-Negotiable B/L	3
4. Packing List	4
5. Package-Wise Weighing & Measuring Certificates	4
6. Guarantee & Test Certificates	3
7. Certificate of Origin	3
8. Freight Payment Receipt Invoice	4
9. Insurance Payment Receipt / Invoice	3

9.0 GUARANTEES

The Vendor shall guarantee that all Equipments to be supplied shall strictly comply with the characteristics, requirements and specifications referred to in the Purchase Order, that the materials used are new and free from apparent and latent defects, that the manufacture is carried out in accordance with the best working practices and up to-date techniques and complies with all specifications stipulated in the Purchase Order.

Approval and/or comments by OWNER on manufacturer specifications, drawings and technical documents will in no way release the manufacturer of his full responsibility regarding his supply as stipulated in the purchase order. Inspection and or witnessing tests by OWNER and their acceptance, of such tests and of supply of equipment/material thereof will in no event relieve the manufacturer from his responsibility contained therein.

The warranty shall be for a period of 12 months from the date of initial commissioning or for a period of not less than 18 months from the date of shipment/dispatch of supplied Equipment / Material, whichever is earlier.

The manufacturer shall deliver to the Owner, at the time of delivery, the written warranty in a form satisfactory to OWNER that the equipment/material being supplied is brand new, has been manufactured in accordance with the drawings, specification and other documents and that, should any defect develop during the warranty period due to but not limited to the improper material, workmanship, instruction, practices, assembly or arrangement of the same, together with any other work effected in correcting such defects will upon written notice, be made good by the manufacturer at no cost to OWNER. All such items of equipment/material repaired or replaced shall be like-wise warranted by the manufacturer for 12 months from the date of completion of such repair or replacement.

If defects are found and the Vendor is not in a position to take the necessary action to carry out the repairs within the time required by OWNER and agreed upon between OWNER and Vendor according to OWNER requirements. OWNER shall have such modification and repairs made by others and the resultant expenses will be charged to the Vendor. It is understood that in this case the Vendor shall not be relieved of guarantee contractual obligations.

Zishan Engineers (Pvt.) Ltd.
An ISO 9001-2015 certified company,
47/F, Block 6, PECHS, Karachi-Pakistan
Tel: (92-21) 34393045-48 & 34310151-54
Fax: (92-21) 34533430 & 34310156
E-mail : contact@zishanengineers.com,
Web : www.zishanengineers.com

Document No.	151-6-SPE-004
Revision	0
Date	29-01-2019
Total Pages (inc front cover)	20

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ATTOCK PETROLEUM LIMITED

PORT QASIM BULK OIL TERMINAL PROJECT

SPECIFICATION FOR

DIESEL ENGINE GENERATORS

ISSUED FOR CONSTRUCTION

Rev.	Date	Description	Prepared By	Checked By	Approved By
0	29-01-2019	Issued for Construction	MHK	MAK	MMM
A	06-12-2018	Issued for Tender	MHK	MAK	MMM

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1.0 SCOPE

1.1 This specification covers the minimum basic requirements for the engineering, design, manufacturing, inspection, testing, commissioning and supply of two diesel engine generators (G01 & G-02) as specified herein and in the data sheets 151-4-DSE-002 & 003 respectively.

1.2 Definitions

Following definitions apply throughout this document:

- Owner: Attock Petroleum Limited.
- Owner's Representative/Engineer: Person or entity authorized by Attock Petroleum to manage the work on behalf of Owner.
- Contractor: The organization engaged by Owner to perform the Work described in this document.

1.3 Errors or Omissions

1.3.1 The review and comment by the Owner or its representative of any Supplier's drawings, procedures or documents shall only indicate acceptance of general requirements and shall not relieve the Supplier of its obligations to comply with the requirements of this specification and other related parts of the contract documents.

1.3.2 Any errors or omissions noted by the Supplier in this Specification shall be immediately brought to the attention of the Owner.

1.4 Deviations

All deviations to this specification, other specifications or attachments shall be brought to the knowledge of the Owner in the bid. All deviations made during the procurement, design, manufacturing, testing and inspection shall be with written approval of the Owner prior to execution of the work. Such deviations shall be shown in the documentation prepared by the Supplier.

1.5 Conflicting Requirements

In the event of conflict, inconsistency or ambiguity between the contract scope of work, this Specification, National Codes & Standards referenced in this Specification or any other documents, the Supplier shall refer to the Owner whose decision shall prevail.

1.6 General

1.6.1 The Diesel generator set and auxiliary equipment shall be supplied by a Supplier qualified by a minimum of five (5) years of experience in manufacturing units of comparable rating at the proposed point of manufacture. Only Diesel generator, which has a proven satisfactory history of operation for at least five (5) years, will be considered.

1.6.2 The following items shall be included for each generator package, as a minimum requirement:

- One Diesel Engine driving the Generator
- Alternator and associated excitation system and voltage regulator
- Exhaust ducting/pipe
- Inlet air filter
- Generator control panel with monitoring instruments (oil and water temperature and pressure gauges, switches and control and shutdown facilities etc.) as per minimum requirements mentioned in specifications or data sheets.
- Generator protection switchgear
- System Earthing
- Starter, Batteries and battery charger
- Wiring of on skid equipment to any on-skid panels and devices
- Special tools and spare parts required for initial commissioning

- Factory Testing
- Preparation for shipment
- Documentation
- Supervision of site installation and assembly
- Pre-commissioning, Commissioning, Site and performance testing

1.6.3 The package shall be suitable for continuous duty power generation and shall be capable of producing the required power at site ambient conditions and 0.8 power factor as indicated on the data sheets. The unit shall include, but not be limited to, the components described in this specification, and the Diesel Engine Generator Data Sheets.

1.7 Unit Responsibility

The SUPPLIER shall be responsible for the complete design, manufacture, supply, inspection and testing of the Diesel Engine Generator, including full compliance with all applicable design codes and standards, including those listed in Section 2.0 of this document and the requirements of the certifying authority, if applicable. The SUPPLIER shall handle and expedite drawings and data, and supervise and coordinate all inspection and testing. The SUPPLIER shall also be responsible for furnishing all the associated requirements including provision of System Earthing and all protection switchgear as specified in the data sheet.

SUPPLIER shall guarantee that all material and parts included in construction of the specified Diesel Engine Generator shall be new, unused and of the required/ specified grade.

2.0 CODES, STANDARDS AND SPECIFICATIONS

2.1 Codes, Standards and Regulations

The Diesel Engine Generator shall be designed, manufactured and tested in accordance with the requirements of this specification, other referenced Project Specifications and the Latest Editions of following Codes, Standards and Statutory Regulations (where applicable):

2.2 **ANSI - American National Standards Institute**

ANSI C57.13	Standard Requirements for Instrument Transformers
ANSI C50.10	Rotating Electrical Machinery – Synchronous Machines
ANSI C50.13	Rotating Electrical Machinery – Cylindrical Rotor Synchronous Generators

2.3 **NEMA - National Electrical Manufacturers Association**

NEMA MG 1	Motors and Generators

2.4 **NFPA - National Fire Protection Association**

NFPA 70	National Electrical Code

2.5 **BS – British Standards**

4999	General Requirements for Rotating Electrical Machines
7671	Requirements for Electrical Installations

2.6 **IEC – International Electrotechnical Commission**

60034	Rotating Electrical Machines
60072	Dimensions and Output Ratings for Rotating Electrical Machines
60079	Electrical Apparatus for Explosive Atmospheres
60085	Thermal Evaluation and Classification of Electrical Insulation
60185	Current Transformers
60529	Classification of Degree of Protection Provided By Enclosures
60909	Short-Circuit Calculation in Three –Phase A.C. Systems

Equivalent codes can only be used on the approval of the OWNER

The governing body for electrical codes and standards used in this project shall be the International Electrotechnical Commission (IEC).

Wherever this specification refers electrical scope to the NEC it is the Supplier's responsibility to adopt the equivalent IEC codes and standards and to request written approval from the OWNER if there are to be any exceptions to IEC codes and standards.

3.0 BASIC DESIGN

3.1 General

3.1.1 All materials, equipment and parts comprising the units specified above shall be new, and of current manufacture.

3.1.2 Equipment shall meet all applicable codes, including those listed in Section 2. Proven standard SUPPLIER equipment supply shall be considered as an option.

3.1.3 The equipment covered by this specification shall be suitable for the specified operating conditions and shall be designed and constructed for a tropical environment, where ambient air temperatures can vary from 20 deg C to 37.8 deg C and relative humidity from 60 to 100% (condensing).

3.2 Rating

3.2.1 The Diesel Generator capability in overload (110% MCR for 1 hour in a 12 hour period) shall exceed the peak demand of all loads connected to the essential bus operating simultaneously. The maximum allowed frequency variation shall be +/- 2% and maximum voltage variation shall be +/-10%.

3.3 Generator Design

3.3.1 The generator shall be a 400V, three-phase and Neutral, 50Hz brushless, synchronous type built to IEC codes and standards.

3.3.2 The insulation system, including leads, shall consist of low-hygroscopic material. The system shall be Class F insulation with tropicalization and anti-fungus treatment. The temperature rise, above an ambient of 40°C, shall not exceed 80°C.

3.3.3 Balance adjustment shall be made only by addition of weights. Generators shall have provisions for possible future rotor balancing in a maintenance shop by the addition of weights.

3.3.4 The generator shall have two (2) stator winding RTDs per phase. Each generator bearing shall have one RTD. The RTD's shall be platinum, 3 wires, 100 ohms (Ω) at 0° C.

3.3.5 The generator final power connection shall be a 6-lead machine for single and 3-phase load. The generator stator winding shall be a 6-lead unit. The leads shall be brought out in a sheet metal, termination chamber. Entry into this chamber shall be possible through the top, sides or bottom.

Generator stator leads shall be WYE connected to copper bus bars in the generator terminal box. The neutral shall be insulated from the frame. The bus bars shall be rigidly attached to the generator using insulators of adequate strength. The bus bars shall be drilled for field connection of cable/lugs as specified. Burrs shall be removed from the drilled holes.

3.3.6 Wiring connections shall be from the side or bottom.

3.3.7 Proven supplier standard will be considered as an option.

3.4 **Mechanical Design**

3.4.1 Mounting

3.4.1.1 The Diesel Generator set, including the local gage panel / control panel and radiator, shall be mounted and shipped on a single steel skid, and shall be provided with suitable vibration dampers.

3.4.2 Fuel and Fuel System

3.4.2.1 Using Diesel fuel, the engine shall be capable of starting and operating at the minimum site ambient temperature specified on the data sheets.

3.4.2.2 The SUPPLIER shall furnish a day tank and associated fuel piping. The day tank capacity shall be as specified in the data sheets. The day tank shall have a valved drain, an adequately sized breather vent designed to exclude dust and water from the tank, and a tank capacity sight glass. The fuel system shall incorporate flexible fuel lines between the day tank and the engine to isolate vibration. The day tank shall have low and high level alarm switches to control the refilling. Tank shall also have secondary containment.

3.4.2.3 The fuel filter shall be located such that spilled fuel cannot fall on hot parts of the engine or generator. A cleanable primary fuel strainer shall be used to collect sediment between the tank and the main engine fuel filter. A fuel/water separator shall protect the system from water damage.

3.4.3 Engine Air Intake

Engine intake air filter shall be a combined pre-cleaner (e.g., inertial separator) and dry filter arrangement with a local differential pressure indicator. An insect screen shall be installed ahead of the intake air filters.

3.4.4 Exhaust System

3.4.4.1 The Diesel engine shall be equipped with an exhaust silencer of the grade specified on the data sheets.

3.4.4.2 The SUPPLIER shall supply the complete exhaust system, including silencer, companion flanges, flexible stainless steel bellows-type exhaust fittings, and rain cap. The system shall also include extensions, if necessary to the exhaust pipe in order to penetrate the roof of the building.

3.4.5 Speed Governing

3.4.5.1 The governor shall be a Woodward 2301A type or an equivalent approved by OWNER.

3.4.5.2 In the event of over speed or emergency shutdown a device shall be provided which shuts off fuel, air, or both, to the Diesel engine.

3.4.6 Starting System

3.4.6.1 Starting Motor

A DC electric starting system with a positive engagement drive shall be furnished.

3.4.6.2 Controls

In addition to automatic start-stop sequences controlled by the AMF Panel / Control Panel, manual start-stop shall be provided with adequate overrides in the generator control panel. Crank cycle circuitry for multiple crank attempts shall be provided by the SUPPLIER.

3.4.7 Cooling

3.4.7.1 The engine cooling system shall be a water cooled, closed-circuit design. The system shall have sufficient capacity to maintain stable operating temperatures at maximum engine output and under the worst site conditions. The coolant pump shall be integral with the engine.

3.4.7.2 The engine-cooling fan shall be the blower type. The fan, fan drive, and fan belts shall be covered with 2.0 mm (minimum) steel mesh guarding, to protect personnel from injury.

3.4.7.3 Coolant for the engine cooling system shall comply with the specification requirements of the Diesel engine manufacturer.

3.4.8 Lubrication

3.4.8.1 The engine main lube oil pump shall be the positive-displacement gear-driven type that is integral with the engine, and shall be easily accessible for maintenance.

3.4.8.2 An oil cooler shall be provided to limit excessive lube oil temperatures.

3.4.8.3 Lube oil filters shall be located downstream from the lube oil coolers over a drip pan.

3.4.8.4 The Diesel generator set shall include an easily accessible provision for lube oil drainage at the edge of the base or rails.

3.4.9 Generator Bearings

3.4.9.1 Anti-friction bearings shall have no filling slots. Bearing racemetal temperature shall not exceed 90°C based on a maximum ambient temperature of 40°C.

3.4.9.2 Regreasable bearings shall be provided with two (2) NPT-tapped and- plugged holes, and fill-in and drainage plugs. The holes shall be provided with threaded Type 300 Series stainless steel plugs. Sealed anti-friction bearings shall be installed by SUPPLIER.

3.4.9.3 Bearings shall be serviceable without moving or disconnecting the generator. Inaccessible grease fittings shall be tubed to extend to the edge of the skid for ease of maintenance.

3.4.9.4 Sleeve-type bearings shall be equipped with split, labyrinth-type end seals and deflectors where the shaft passes through the housing. Lip-type seals shall not be used. The sleeve bearing shell metal temperature shall not exceed 90°C based on a maximum ambient temperature of 40°C.

3.4.9.5 Two-bearing generators shall have interchangeable bearings.

3.4.9.6 A two-bearing generator shall have one bearing electrically insulated from the generator frame or baseplate.

3.4.10 Vibration

The generator set manufacturer shall provide a Torsional Vibration Analysis Report for the Diesel generator set specified. Alternatively, if proposed generator set is a field proven and identical design to sets manufactured previously at the proposed point of manufacture, manufacturer can provide a certified letter or certificate so stating in lieu of a torsional report.

3.4.11 Nameplates and Rotation Arrows

3.4.11.1 Nameplates and rotation arrows shall be Type 316 stainless steel or Monel, securely fastened by pins of similar material. They shall be located such that the information can be read after the equipment is installed. Entries shall be marked by etching, engraving or other methods of permanent marking.

3.4.11.2 The following data is required on the generator nameplate, in addition to the requirements of IEC codes and standards and may be on a separate nameplate:

- Buyer's purchase order number
- Manufacturer's location
- Rotor weight
- Manufacturer's order reference number
- Insulation system designation
- Generating voltage in KV
- Generator current in amps
- Design Power factor
- KVA Rating

4.0 ENGINE-GENERATOR CONTROL AND SWITCHGEAR

4.1 General

4.1.1 Generator Control Panels shall include, but not be limited to, the following equipment. Any additional equipment for the required operation and control shall also be supplied.

a) Driver and generator temperature monitoring equipment
b) Governor
c) Automatic voltage regulator and reference adjuster
d) Starting sequencer
e) Exciter diode monitoring system
f) Canned message display with first out annunciation
g) Excitation limiter
h) Overspeed switch
i) Automatic generator loading control
j) AMF+ATS Panel for switching over to generator on failure of utility power.

Individual control switch for each circuit breaker capable of being controlled from the generator control panel or AMF Panel.

4.1.2 The control panel shall contain, but not be limited to, the following readout devices:

- Voltmeter, 1.5% accuracy
- Ammeter, 1.5% accuracy
- Power Factor Meter, + 5% accuracy
- Frequency meter, + 5% accuracy
- Kilowatt meter with an auxiliary RS-232 digital output for remote monitoring
- Engine tachometer
- System DC voltmeter
- Engine running hour meter
- Power meter

4.1.3 The control panel shall provide the following minimum annunciators containing open dry contacts for the following summary of seven (7) alarms/status and four (4) shutdowns listed below:

- Generator on load (status)
- Charger failure (alarm)
- Low battery voltage (alarm)
- Low fuel level (alarm)
- High coolant temperature (alarm)
- Low oil pressure (alarm)
- High coolant temperature (shutdown)
- Low oil pressure (shutdown)
- Overcrank (shutdown)
- Overspeed (shutdown)

Note: A proven standard supplier supply package with the approval of owner shall be considered as an alternative option.

4.1.4 Each generator control panel shall be a free standing IP55 enclosure, completely factory assembled, wired, and tested. Panels shall require front access only.

4.1.5 Panels shall have removable lifting angles or eyes and a channel base suitable for rolling or skidding. Panels shall be supplied with an isolated instrument copper ground bus and an enclosure copper ground bus. The panel shall be suitable for field wiring to enter from either above or below. Removable gland plates shall be supplied for incoming metal clad field cable termination.

4.1.6 Each generator control panel will be provided dual 230VAC control power feeders from UPS system. The generator control panels shall be equipped with dual regulated power supply units for the required panel control power. Control Power shall be 24V DC.

4.1.7 Fuses, switches, and other miscellaneous accessories shall be located inside the panel such that all equipment can be easily serviced and maintained.

4.1.8 Generator Control Panel shall be provided with interlock provision with ATS+AMF.

4.2 Generator Protection

4.2.1 Generators shall be provided with sufficient devices to protect the unit as required by the Supplier and this specification. Following are the minimum requirements

- Protective relays – generator
- Over / under voltage (27/59)
- Over under frequency (81 O/U)
- Reverse Power (32G)
- Protective relays – utility
- Over / under voltage (27/59)
- Over under frequency (81 O/U)
- Reverse Power (32G)
- Negative phase sequence, Current (46N)
- Negative phase sequence, Voltage (47N)

5.0 ACCESSORIES

5.1 Voltage Regulator

5.1.1 Generators shall incorporate an excitation system with an automatic voltage regulator (AVR). The AVR unit shall maintain generator terminal voltage within + 1% of nominal value over the load range, up to full load. Voltage level adjustment shall be + 5%.

5.1.2 The automatic voltage regulator shall use three-phase sensing and shall be a temperature-compensated, solid-state design. The solid state regulator module shall be shock-mounted and epoxy encapsulated for protection against vibration and atmospheric deterioration. It shall be located in the generator control panel.

5.1.3 The voltage regulator shall be of an asynchronous, pulse-width modulated design that is insensitive to severe load induced wave shape distortion from SCR or thyristor loads.

5.2 Battery and Battery Charger

Maintenance Free, Sealed Lead-acid storage batteries of the heavy-duty diesel starting type shall be provided. The battery voltage shall be compatible with the starting system. A corrosion-resistant battery rack with necessary cables and clamps shall be provided on the skid. The batteries shall be capable of cranking the engine for a minimum of five (5) 30-second cranking periods at the minimum rated ambient conditions.

A current-limiting, float-equalize, Underwriter Laboratories (UL) listed charger shall be furnished to automatically recharge the batteries. The charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full-wave rectifiers, voltage surge suppressers, a DC ammeter, a DC voltmeter, and fused DC output. AC input voltage shall be as specified on the data sheets. Amperage output shall be no less than 5 amperes. It shall be mounted in the generator control panel.

5.3 Space Heaters

Generator shall be supplied with space heaters. The supply voltage will be found on the data sheets. The heaters shall protect the generator from condensing moisture and shall be switched on automatically when the generator is not running.

6.0 EARTHING SYSTEM

6.1 One foot of the generator shall be drilled and tapped to accommodate one 12 mm stainless steel grounding bolt.

6.2 The Generator skid shall be provided with two stainless steel grounding pads located at diagonally opposite corners of the skid. Each pad shall be a minimum of 50 mm square and made of 20 mm plate smooth machined on one face and drilled and tapped for 12 mm UNC stainless steel bolt. Pads shall be seal welded to the skid.

7.0 TESTING AND INSPECTION

7.1 General

Inspection and testing of the Diesel generator set shall be carried out as per International Standard.

7.2 Testing

7.2.1 Performance Tests

Performance tests are required for the generator set. Performance tests shall be conducted only after all pressures and temperatures have equalized. The tests shall be comprised of the following:

- 30 minutes running at 50% load
- 30 minutes running at 75% load
- 4 hours running at 100% load
- 15 minutes running at 110% load (overload) (not applicable to standby rated units)
- Cold start with load step check
- Full load rejection governor response

The following tolerances shall be applied for the full load test in the evaluation of the performance test results:

- Generator power shall be within 5% of rating specified.
- Fuel consumption shall be within 3% of that quoted by manufacturer

Note: A proven standard SUPPLIER supply package will be considered as an alternative option.

The Diesel generator set shall be fully equipped with all components and accessories. Operating conditions (such as barometric pressure, ambient temperature and humidity) and the fuel heat value shall be indicated on the performance certificates.

Within 15 calendar days of the final successful tests, the SUPPLIER must send to OWNER one (1) original, eight (8) hard and three (3) soft copies of all material and test certificates.

7.2.2 Additional Tests

The following additional tests are required for the Diesel Generator set:

7.2.2.1 Test engine over speed trip system

7.2.2.2 Test Diesel Generator set starting system to prove that consecutively at least five (5) starts can be made as specified.

7.2.2.3 Connect the remote generator control panel and verify operation of Diesel Generator set alarms, shutdowns and control functions.

7.3 **Reports and Acceptance Certificates**

Preliminary and final dossiers shall be prepared as described in the requisition document. Other relevant certificates shall also be provided together with equipment release note.

8.0 **PREPARATION FOR SHIPMENT**

8.1 Each unit shall be suitably prepared for the type and mode of shipment specified.

The preparation shall be suitable for up to 6 months of outdoor storage from the time of shipment in a manner requiring no disassembly prior to operation.

8.2 The Supplier shall provide the purchaser with the job site storage instructions for the generator sets.

8.3 Preparation for shipment shall be as specified in the following paragraphs as a minimum.

8.3.1 Exterior surfaces, except for machined surfaces, shall be primed and painted.

8.3.2 After having been thoroughly drained and cleaned, internal areas of bearings and all auxiliary equipment in oil lubrication systems using carbon steel shall be coated with suitable oil- soluble rust preventive.

8.3.3 Flanged openings shall be provided with metal closures at least 5 millimeters thick, with synthetic rubber gaskets. At least four full-diameter bolts shall be used for flanged openings.

8.3.4 The equipment shall be mounted on a rigid skid suitable for handling by forklift truck or crane.

8.3.5 The rotor of sleeve-bearing generators shall be blocked to prevent axial and radial movement.

8.3.6 Space heater leads shall be accessible without disturbing the shipping package. The leads shall be suitably tagged for easy identification.

8.3.7 Lifting points or lugs shall be clearly marked.

8.3.8 Open ends of tubes and pipes shall be capped. Taping is not adequate for protection.

8.3.9 Exhaust silencer openings shall be wrapped with plastic to prevent the entrance of rain.

8.3.10 All doors shall be locked closed. Keys shall be securely attached to the skid. Duplicate keys shall be given to the Owner during testing.

8.3.11 Separate control panels shall be crated and wrapped with plastic to prevent the entrance of moisture. Shipment by water requires waterproofing.

8.3.12 All field openings in generator skid or enclosure, such as those for bus duct, cable bus, or multi-cable transits, shall be filled for shipment using marine grade plywood.

8.4 The generator shall be properly identified with item number, serial number and any other information required by the purchase order. All material shipped in separate crates shall be suitably identified with securely affixed, corrosion resistant metal tags indicating the item and serial number of the equipment for which it is intended.

The fit-up and assembly of machine-mounted piping and other equipment shall be completed in the Supplier’s shop before shipping.

9.0 SPARE PARTS

The Supplier shall provide separate recommended spare parts lists with prices for commissioning, start up, emergency and two (2) years operation. All spare parts shall be tagged as shown on the list of materials and shall be shipped at the same time as the main equipment.

10.0 DOCUMENTATION

The SUPPLIER shall submit the drawings and Documentation for the equipment supplied. In addition to fuel consumption data, the SUPPLIER shall also provide ventilation, combustion and exhaust airflow requirements.

For indoor installation, the exhaust piping layout and proposed location shall be submitted to the OWNER for approval.

SUPPLIER shall supply all dynamic related data for the generator and driver to include the following:

- Weight of all individual major components: generator and driver
- Weight of rotating masses of generator and driver.
- Critical speeds if applicable.
- Maximum eccentricities (bearing clearances) to be expected of generator shaft, gear shafts, and driver shaft
- Comprehensive start-up, operating and maintenance manuals to be provided.

11.0 SITE ACCEPTANCE TEST (SAT) AND COMMISSIONING ASSISTANCE

The SUPPLIER shall be responsible to undertake a SAT prior to the commissioning and pre-commissioning activities. It is also envisaged that Supplier's expert(s) will be required to assist during pre-commissioning and commissioning of the equipment at the time of plant start up. The duration of the stay is expected to be about four (4) weeks.

Supplier's expert(s) will be also required to train (Classroom and field training) Owner's operations and maintenance personnel. All costs associated to the logistics required to perform these activities shall be included in the bid price. The OWNER will reimburse only local transportation at actual costs.

12.0 GUARANTEE

12.1 Supplier guarantees that each item provided will be free of defects in design, material and workmanship. The guarantee shall apply to discrepancies and defects that are discovered within the shorter of 18 months after final acceptance, or 36 months after being received at the jobsite. If corrective work is performed on an item under this guarantee, the guarantee shall also apply to discrepancies and defects in the corrective work that are discovered within the shorter of 12 months after the corrected item is again placed in operation, or 18 months after completion of the corrective work. These guarantee terms shall be extended for any period that an item cannot be operated as a result of discrepancies or defects in any item.

12.2 In addition, Supplier shall disclose to purchaser each proposed design, manufacturing procedure, material, component, or assembly which does not have at least 2 years' satisfactory field-operating experience in similar service. If Supplier fails to make such disclosure to Owner in writing prior to accepting a purchase order, the warranty shall be extended for 2 additional years beyond that specified above, and the warranty obligations shall be expanded to include payment of all direct costs to Owner that may result from the use of such procedures, materials, components, or assemblies. Direct costs include, but are not limited to the following:

- Replacement parts
- Field labor required for removal and re-installation
- Factory labor to complete repair
- Shipping and freight
- Inspection and testing

Alternately, Owner reserves the right to reject the item of equipment. If Owner elects this option, Supplier shall bear all costs to provide equipment having two years' satisfactory operating experience in similar service.

DATA SHEETS

Zishan Engineers (Pvt.) Ltd.
An ISO 9001-2015 certified company,
47/F, Block 6, PECHS, Karachi-Pakistan
Tel: (92-21) 34393045-48 & 34310151-54
Fax: (92-21) 34533430 & 34310156
E-mail : contact@zishanengineers.com,
Web : www.zishanengineers.com

Document No.	151-6-DSE-002
Revision	0
Date	29-01-2019
Total Pages (inc front cover)	7

Attock

ATTOCK PETROLEUM LIMITED

PORT QASIM BULK OIL TERMINAL PROJECT

DATA SHEET FOR
DIESEL ENGINE GENERATOR SET (G-01)

ISSUED FOR CONSTRUCTION

Rev.	Date	Description	Prepared By	Checked By	Approved By
0	29-01-2019	Issued for Construction	MAK	MMM	NAK
B	24-12-2018	Re-Issued for Tender	MAK	MMM	NAK
A	06-12-2018	Issued for Tender	MAK	MMM	NAK

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-01)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-002		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	2 OF 7

DIESEL ENGINE

SITE CONDITIONS

Ambient Temp.(°C)	**Minimum**	15	**Maximum**	50	**Humidity:** 30 - 100%	**Altitude (Meters):**	6 - 10 m AMSL
Area Classification:	☐ Hazardous		■ Non-hazardous		☐ Other		
Atmosphere:	☐ Desert		☐ Marine		■ Corrosive	☐ Non-Corrosive	
Barometric Pressure	1013mBar						
Siesmic Zone:	Zone-2B						
Wind Velocity:	■ Maximum 10 miles/hr		■ Design 12 miles/hr				
	☐ Others						

CHARACTERISTICS

Aspiration:	Turbo Charged	**Type of Fuel:**	Diesel	**Service:**	Continuous Duty

CONSTRUCTION

Manufacturing Standards:				
Make:				
Type/Model:				
Number of Cylinders:	☐ In line:	☐ V:	No. of Cycles:	
Bore (mm):				
Storke (mm):				
Displacement (cm3):				
Operating Cycles:				
Compression Ratio:				
Pressure Charged:	☐ Yes	☐ No		
Direction of rotation facing Fly Wheel:				
Cooling:	☐ Air	■ Water Cooled		
Baseplate:	■ Yes	☐ No	☐ Separated	■ Combined with driven equipment

STARTING

Starting Equipment:	■ Electric	☐ Air	■ 24 V DC	☐ Other
Air Compressor:	☐ Yes	■ No	☐ Capacity (Nm^3/hr)	
	☐ Driven By:		☐ Working Pressure:	
	☐ Make & Type:			
	☐ Working Pressure Reducing Valve:			

COOLING

Engine Cooling System:	☐ Air	■ Water	☐	■ Closed
Fan Drive:	■ Yes	☐ No	☐ For Suction	☐ Pusher
Type of Drive:				
Water Pump:	■ Yes	☐ No		
Oil Cooler:	■ Yes	☐ No	☐ Separated	☐ Combined
Intercooler for Pressure Charger:		☐ Yes	☐ No	

FILTERING

Fuel Filter:	■ Yes	☐ No	☐ Single	Duplex	
Air Filter:	■ Yes	☐ No			
	Combined with cyclone type:		☐ Yes	No	
Oil Filter:	■ Yes	☐ No	☐ Single	■ Duplex	☐ Bypass
	☐ Full Flow				
Magnetic Filter:	☐ Yes	☐ No			

Project		Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT		Diesel Engine Generator Set (G-01)			
Consultant		**Document No.**		**Revision**	**Date**
ZEL	ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-002		0	29-01-2019
Client		**Prepared By**	**Checked By**	**Approved By**	**SHEET**
Attock	ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	3 OF 7

DIESEL ENGINE

OPERATING CONDITIONS									
Power required:									
Power (kW):	☐ Normal:		☐ Rated:						
Speed (rpm):	☐ Normal:		☐ Rated:						
PERFORMANCE									
	Power (kW)				**Speed (rpm)**				
	Min.		Max.		Min.		Max.		
Continuous rating to DIN 6270									
Rating "B" to DIN 6270									
Short time rating to DIN 70020									
SHOP TEST									
Running Performance:	■ Yes		☐ No						
Mechanical running:	■ Yes		☐ No						
Others:									
WEIGHTS									
Engine (kg):				**Accessories (kg):**					
INSTRUMENTATION									
Instrument and Starting Panel:	■ Yes		☐ No		☐ On engine frame				
Panel mounting:	■ Anti vibration								
Tachometer:	■ Yes	☐ No		Electrical	☐ Mechanical				
Pressure indicator:	■ On Oil	☐ On Cooling Water		☐ After Filter	☐ Befor Filter				
Temperature indicator:	■ On Oil	■ On Cooling Water		■ After Filter	■ Befor Filter				
Exhaust temperature measurement:	☐ Yes	☐ No							
Battery Charging Indicator:	■ Yes	☐ No		■ Panel Mounted					
PRESSURE CHARGER									
Pressure Charger:	■ Yes	☐ No	■ Turbo	Roots	Type				
Exhaust Silence:	■ Yes	☐ No	■ Hospital Grade	Other					
Exhaust manifold:	■ Yes	☐ No							
Preoiling pump	☐ Yes	☐ No							
BATTERY CHARGING									
Rectifier:	■ Yes	☐ No							
Input:	400 VAC ± 10%	Amps.	Cos Phi=0.8 Lagging	50 Hz.± 2 Hz.					
Output:	24 VDC ± 1%	Amps.							
Voltage, Current Relays:	■ Yes	☐ No							
Batteries:	■ Yes	☐ No	■ Ni-Cd.	☐ Lead Acid (VRLA)	☐ Other				
Voltmeter (Both Input & Output):	■ Yes	☐ No							
Ammeter (Both Input & Output):	■ Yes	☐ No		☐					
Rectifier ON/OFF Switch:	■ Yes	☐ No							
SAFETY DEVICES									
Low Oil Pressure:	■ Yes	☐ No	■ Alarm	■ Shutdown					
High Engine Oil Temperature:	■ Yes	☐ No	■ Alarm	■ Shutdown					
High Water Temperature:	■ Yes	☐ No	■ Alarm	■ Shutdown					
Overspeed:	■ Yes	☐ No	■ Alarm	■ Shutdown					
Low Water Level:	■ Yes	☐ No	■ Alarm	■ Shutdown					
Over Cranking (Start failure):	■ Yes	☐ No	■ Alarm	■ Shutdown					
Emergency Stop:	■ Yes	☐ No	■ Alarm	■ Shutdown					
Intake Air shut off valve:	■ Yes	☐ No	☐ Alarm	☐ Shutdown					
Safety Guards:	■ Yes	☐ No							
Fuel Gas Pressure:	■ Yes	☐ No	■ Alarm	☐ Shutdown					
Knock-out Pot Level High:	■ Yes	☐ No	■ Alarm	☐ Shutdown					
Manual Lockout at skid	■ Yes	☐ No	■	☐					
Fail to Start:	■ Yes	☐ No	■ Alarm						
Low and high Oil level monitoring:	■ Yes	☐ No	■ Alarm	☐ Shutdown					
Low Fuel Switch:	■ Yes	☐ No	■ Alarm	☐ Shutdown					

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-01)			
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Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
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DIESEL ENGINE

POWER TAKE-OFF						
Friction Clutch:	☐	Yes	☐	No		
Hydraulic Coupling:	☐	Yes	☐	No		
Torque Converter:	☐	Yes	☐	No		
Gear Box:	☐	Yes	☐	No		
Coupling:	☐	Yes	☐	No		
V-Belt Pulley:	☐	Yes	☐	No		
SPEED GOVERNING						
Governor:	■	Yes				
	■	Electronic			☐	Hydraulic
Governor Speed:	☐	Variable			☐	Fixed

ENGINE AIR REQUIRMENT			
Combustion:	SCFM	**Cooling**	
Combustion Air Quality			
FUEL SYSTEM			
Type	Diesel	**Heating Value**	BTU / MIN.
Pressure	bar	**Consumption**	SCFM or GPM
OIL SYSTEM			
Capacity:	Liters	**Type and Grade Lubrication Oil**	

Notes:

1. The Supplier shall fill-in all the missing information in the Data Sheets, and submit with bid.

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-01)			
Consultant	**Document No.**		**Revision**	**Date**
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Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
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SYNCHRONOUS ALTERNATORS

SITE CONDITIONS							
Ambient Temp.(°C)	**Minimum**	5	**Maximum**	60	**Humidity:**	100%	**Altitude (Meters):** 62m AMSL
Area Classification:	☐	Hazardous	■	Non-hazardous	☐	Other	
Atmosphere:	☐	Desert	☐	Marine	■	Corrosive	☐ Non-Corrosive
Barometric Pressure	■	1000mBar					
Siesmic Zone:		Zone-2B					
Wind Velocity:	■	Maximum 100 km/hr	■	Design 166 km/hr			
	☐	Others					

CHARACTERISTICS			
Utilisation:		**Service:**	Prime
Useful Power (kW):	800		
Apparent Power (kVA):	1000	**Power Factor = 0.8**	
Synchronous Speed (rpm):	1500	**Frequency (Hz):**	50
Voltage (V):	400	**Number of Phase:**	3 + Neutral. Wire: 4
Driving Machine:	DIESEL ENGINE	**Neutral Grounding :**	Low Resistance
Coupling:		**Shaft and Diameter:**	
Direction of Rotation at the coupling end:		**Shaft Height:**	
Parallel Operation:	No		
Excitation:	As per specification	**Cooling Method:**	CACA
Automatic Voltage Regulation:	Yes	**Heating Class:**	
Fire Protection:		**Maximum Permissible Voltage Dip.:**	5%

TYPE		
Protection:	IP 55	(In accordance with IEC 529)
Gas Explosing Proofing:		(In accordance with IEC 79.1)
Subdivision (A, B or C):		(In accordance with IEC 79.1)
Temperature (T1 to T6):		(In accordance with IEC 79.1)
Enhanced Safety:		(In accordance with IEC 79.7)
Internal Overpressure:		(In accordance with IEC 79.2)

STATOR				
Casing Orientation (H or V):	Horizontal		**Bearing Type:**	Ball / Roller
Mounting:	SKID		**Prestressed Rolling:**	
Insulation Class:	F		**Smooth:**	
Winding Connection:	STAR	4 wire	**Insulated:**	
Temperature Detectors:	YES	(PT-100 Type)	**Anti-Condensation Heater:**	Yes @ 230 V AC

ROTOR			
Winding Meterial:	Copper	**Cooling Method:**	CACA
Insulation Class:	F		

EXCITATION					
Separate Exciter:	Brushless Type	**One end of Shaft:**		**Exciter Insulation Class:**	F
Solid State Excitation:		External:		Rotating Diodes:	

SAFETY DEVICES							
Alternator Reverse Power:	■	Yes	☐	No	■	Alarm	☐ Shutdown
Alternator Earth Fault:	■	Yes	☐	No	■	Alarm	☐ Shutdown
Short Circuit	■	Yes	☐	No	■	Alarm	■ Shutdown
Over / Under Voltage	■	Yes	☐	No	■	Alarm	■ Shutdown
Overload	■	Yes	☐	No	■	Alarm	■ Shutdown
Alternator Winding Temp. High:	■	Yes	☐	No	■	Alarm	☐ Shutdown
Alternator Phase Unbalance:	■	Yes	☐	No	■	Alarm	☐ Shutdown
Alternator Overcurrent:	■	Yes	☐	No	■	Alarm	☐ Shutdown
Other:	See Specification						

TERMINAL BOXES			
Type:	IP 65	**Position seen from Alternator end (Right, Left or Top):**	
Input:	Cable Glands (Brass)	**Cable:**	Flexible
Outside Diameter:	**Dia. On armour:**	**Dia. Under armour:**	

Project		Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT		Diesel Engine Generator Set (G-01)			
Consultant		**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.		151-6-DSE-002		0	29-01-2019
Client		**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED		MAK	MMM	NAK	6 OF 7

SYNCHRONOUS ALTERNATORS

IDENTIFICATION PLATE				
Metal:	316L Stainless Steel			
TESTS				
Tests:	As per Specification			
MANUFACTURER's DATA				
Name:				
Alternator Type/Model:				
Rated Power (kW):				
Rated Power (kVA):				
Cos Phi (Power Factor):				
Rated Current:				
Allowable Overload(%):				
Efficiency at Cos Phi = 1 at Full load:	3/4 Load:	1/2 Load:	1/4 Load:	
Efficiency at Cos Phi = 0.8 at Full load:	3/4 Load:	1/2 Load:	1/4 Load:	
Voltage Regulator Type:				
Bearings Make & Type:		Lubricant:		
REACTANCES				
Synchronous:	**Longitudinal (Xd):**		**Tranverse (Xq):**	
Transient:	**Longitudinal (X'd):**		**Tranverse (X'q):**	
Subtransient:	**Longitudinal (X''d):**		**Tranverse (X''q):**	
Negative Sequence Reactance (X_2):				
Zero Sequence Reactance (Xo):				
Resistance per rotor winding:				
TIME CONSTANTS				
Longitudinal transient off-load ($T'd_O$):				
Longitudinal Subtransient off-load ($T''d_O$):				
Tranverse off-load ((Tq_O):				
SHORT CIRCUIT CURRENTS				
Subtransient:	**Transient:**		**Synchronous:**	
Voltage:		Power:		
ENCLOSURE				
Structural Frame:	■ Hot Dip Galvanized Steel	☐ Stainless Steel	■ Powder Paint Coated Sheet Steel	
WEIGHTS				
Stator:		**Control Panels**		
Rotor:				
Flywheel:				
Engine Generator Skid:				
MISCELLANEOUS				
Max. Allowable Unbalance Load:				
Degree of Protection Generator Enclosure:	IP55			
Degree of Protection Control Panel:	IP55			
Degree of Protection of Terminal Boxes:	IP65			
Rated Generator Circuit Breaker	Nominal:	Short Circuit :	KA rms	KA peak
Engine-Generator Skid Dimensions	Length	Width	Height	

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-01)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-002		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
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GENERATOR CONTROL AND AMF PANEL

AMF PANEL : As per specifications 193-1-SPE-009

Type:	■ Multiple Breaker	☐ Single Breaker		
Mounting:	■ Floor mounted	☐ Wall mounted		
Enclosure:	■ NEMA 3R	☐ NEMA 1	■ Powder Paint Coated Sheet Steel	
Breaker Rating:	**Utility:**	**Generator:** Vendor to specify		
Interrupting rating / Breaking Capacity:	30kA			
Modes of operation:	■ Emergency/Standby	■ No load Test		
Cable entry:	■ Bottom	☐ Top	☐ Side	
System Start Method:	■ Local operator interface	■ Remote contact closure	■ Auto on utility failure	
	☐ Time based			
Neutral bus	■ Full rated	☐ Half rated		
Generator Protective Relays:	■ Over / under voltage	■ Over / under frequency	■ Reverse Power	
	■ Over / under voltage	■ Over / under frequency	■ Reverse Power	
	■ Negative Phase Sequence, Current	■ Negative Phase Sequence, Voltage		

DOCUMENTATION / DRAWINGS

List of Deviations from the Specification

Statement of Compliance

Dimensional Drawing of the Engine/Generator Combination

Dimensional Drawing of Control Panel, Engine Panel, AMF Panel

Schematic Diagrams

Details on Protection Relays, with recommended settings

Details on Local or Regional Service Organization for Both Engine and Generator.

OBSERVATIONS

Notes:

1. Supplier shall fill-in all the missing information in the data sheets and submit with bid.
2. Control Panel will have Start stop buttons, start / stop indications, silencing and testing buttons.

Zishan Engineers (Pvt.) Ltd.
An ISO 9001-2015 certified company,
47/F, Block 6, PECHS, Karachi-Pakistan
Tel: (92-21) 34393045-48 & 34310151-54
Fax: (92-21) 34533430 & 34310156
E-mail : contact@zishanengineers.com,
Web : www.zishanengineers.com

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Total Pages (inc front cover)	7

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ATTOCK PETROLEUM LIMITED

PORT QASIM BULK OIL TERMINAL PROJECT

DATA SHEET FOR
DIESEL ENGINE GENERATOR SET (G-03)

ISSUED FOR CONSTRUCTION

Rev.	Date	Description	Prepared By	Checked By	Approved By
0	29-01-2019	Issued for Construction	MAK	MMM	NAK
B	24-12-2018	Re-Issued for Tender	MAK	MMM	NAK
A	06-12-2018	Issued for Tender	MAK	MMM	NAK

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-004		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	2 OF 7

DIESEL ENGINE

SITE CONDITIONS								
Ambient Temp.(°C)	**Minimum**	15	**Maximum**	50	**Humidity:**	30 - 100%	**Altitude (Meters):**	6 - 10 m AMSL
Area Classification:	☐	Hazardous	■	Non-hazardous	☐	Other		
Atmosphere:	☐	Desert	☐	Marine	■	Corrosive	☐	Non-Corrosive
Barometric Pressure	■	1013mBar						
Siesmic Zone:		Zone-2B						
Wind Velocity:	■	Maximum 10 miles/hr	■	Design 12 miles/hr				
	☐	Others						

CHARACTERISTICS					
Aspiration:	Turbo Charged	**Type of Fuel:**	Diesel	**Service:**	Continuous Duty

CONSTRUCTION								
Manufacturing Standards:								
Make:								
Type/Model:								
Number of Cylinders:	☐	In line:	☐	V:	No. of Cycles:			
Bore (mm):								
Storke (mm):								
Displacement (cm3):								
Operating Cycles:								
Compression Ratio:								
Pressure Charged:	☐	Yes	☐	No				
Direction of rotation facing Fly Wheel:								
Cooling:	☐	Air	■	Water Cooled				
Baseplate:	■	Yes	☐	No	☐	Separated	■	Combined with driven equipment

STARTING								
Starting Equipment:	■	Electric	☐	Air	■	24 V DC	☐	Other
Air Compressor:	☐	Yes	■	No	☐	Capacity (Nm^3/hr)		
	☐	Driven By:			☐	Working Pressure:		
	☐	Make & Type:						
	☐	Working Pressure Reducing Valve:						

COOLING								
Engine Cooling System:	☐	Air	■	Water	☐		■	Closed
Fan Drive:	■	Yes	☐	No	☐	For Suction	☐	Pusher
Type of Drive:								
Water Pump:	■	Yes	☐	No				
Oil Cooler:	■	Yes	☐	No	☐	Separated	☐	Combined
Intercooler for Pressure Charger:			☐	Yes	☐	No		

FILTERING

Fuel Filter:	■	Yes	☐	No	☐	Single	Duplex	
Air Filter:	■	Yes	☐	No				
	Combined with cyclone type:				☐	Yes	No	
Oil Filter:	■	Yes	☐	No	☐	Single	■ Duplex	☐ Bypass
	☐	Full Flow						
Magnetic Filter:	☐	Yes	☐	No				

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-004		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	3 OF 7

DIESEL ENGINE

OPERATING CONDITIONS									
Power required:									
Power (kW):	☐	Normal:	☐	Rated:					
Speed (rpm):	☐	Normal:	☐	Rated:					
PERFORMANCE									
	Power (kW)				**Speed (rpm)**				
	Min.		Max.		Min.		Max.		
Continuous rating to DIN 6270									
Rating "B" to DIN 6270									
Short time rating to DIN 70020									
SHOP TEST									
Running Performance:	■	Yes	☐	No					
Mechanical running:	■	Yes	☐	No					
Others:									
WEIGHTS									
Engine (kg):					**Accessories (kg):**				
INSTRUMENTATION									
Instrument and Starting Panel:	■	Yes	☐	No	☐	On engine frame			
Panel mounting:	■	Anti vibration							
Techometer:	■	Yes	☐	No	■	Electrical	☐	Mechanical	
Pressure indicator:	■	On Oil	☐	On Cooling Water	☐	After Filter	☐	Befor Filter	
Temperature indicator:	■	On Oil	■	On Cooling Water	■	After Filter	■	Befor Filter	
Exhaust temperature measurement:			☐	Yes	☐	No			
Battery Charging Indicator:			■	Yes	☐	No	■	Panel Mounted	
PRESSURE CHARGER									
Pressure Charger:	■	Yes	☐	No	■	Turbo	☐	Roots	Type
Exhaust Silence:	■	Yes	☐	No	■	Hospital Grade	☐	Other	
Exhaust manifold:	■	Yes	☐	No					
Preoiling pump	☐	Yes	☐	No					
BATTERY CHARGING									
Rectifier:	■	Yes	☐	No					
Input:	400 VAC ± 10%		Amps.		Cos Phi=0.8 Lagging		50 Hz.± 2 Hz.		
Output:	24 VDC ± 1%		Amps.						
Voltage, Current Relays:	■	Yes	☐	No					
Batteries:	■	Yes	☐	No	■	Ni-Cd.	☐	Lead Acid (VRLA)	☐ Other
Voltmeter (Both Input & Output):	■	Yes	☐	No					
Ammeter (Both Input & Output):	■	Yes	☐	No	☐				
Rectifier ON/OFF Switch:	■	Yes	☐	No					
SAFETY DEVICES									
Low Oil Pressure:	■	Yes	☐	No	■	Alarm	■	Shutdown	
High Engine Oil Temperature:	■	Yes	☐	No	■	Alarm	■	Shutdown	
High Water Temperature:	■	Yes	☐	No	■	Alarm	■	Shutdown	
Overspeed:	■	Yes	☐	No	■	Alarm	■	Shutdown	
Low Water Level	■	Yes	☐	No	■	Alarm	■	Shutdown	
Over Cranking (Start failure):	■	Yes	☐	No	■	Alarm	■	Shutdown	
Emergency Stop:	■	Yes	☐	No	■	Alarm	■	Shutdown	
Intake Air shut off valve:	■	Yes	☐	No	☐	Alarm	☐	Shutdown	
Safety Guards:	■	Yes	☐	No	■		■		
Fuel Gas Pressure:	■	Yes	☐	No	■	Alarm	☐	Shutdown	
Knock-out Pot Level High:	■	Yes	☐	No	■	Alarm	☐	Shutdown	
Manual Lockout at skid	■	Yes	☐	No	■		☐		
Fail to Start:	■	Yes	☐	No	■	Alarm			
Low and high Oil level monitoring:	■	Yes	☐	No	■	Alarm	☐	Shutdown	
Low Fuel Switch:	■	Yes	☐	No	■	Alarm	☐	Shutdown	

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-004		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	4 OF 7

DIESEL ENGINE

POWER TAKE-OFF				
Friction Clutch:	☐ Yes	☐ No		
Hydraulic Coupling:	☐ Yes	☐ No		
Torque Converter:	☐ Yes	☐ No		
Gear Box:	☐ Yes	☐ No		
Coupling:	☐ Yes	☐ No		
V-Belt Pulley:	☐ Yes	☐ No		
SPEED GOVERNING				
Governor:	■ Yes			
	■ Electronic		☐ Hydraulic	
Governor Speed:	☐ Variable		☐ Fixed	
ENGINE AIR REQUIRMENT				
Combustion:	SCFM	**Cooling**		
Combustion Air Quality				
FUEL SYSTEM				
Type	Diesel	**Heating Value**	BTU/SCF	
Pressure	bar	**Consumption**	SCFM or GPM	
OIL SYSTEM				
Capacity:	Liters	**Type and Grade Lubrication Oil**		

Notes:

1. The Supplier shall fill-in all the missing information in the Data Sheets, and submit with bid.

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-004		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	5 OF 7

SYNCHRONOUS ALTERNATORS

SITE CONDITIONS								
Ambient Temp.(°C)	**Minimum**	5	**Maximum**	60	**Humidity:**	100%	**Altitude (Meters):**	62m AMSL
Area Classification:	☐	Hazardous	■	Non-hazardous	☐	Other		
Atmosphere:	☐	Desert	☐	Marine	■	Corrosive	☐	Non-Corrosive
Barometric Pressure	■	1000mBar						
Siesmic Zone:		Zone-2B						
Wind Velocity:	■	Maximum 100 km/hr	■	Design 166 km/hr				
	☐	Others						

CHARACTERISTICS			
Utilisation:		**Service:**	Prime
Useful Power (kW):	96		
Apparent Power (kVA):	120	**Power Factor = 0.8**	
Synchronous Speed (rpm):	1500	**Frequency (Hz):**	50
Voltage (V):	400	**Number of Phase:**	3 + Neutral. Wire: 4
Driving Machine:	DIESEL ENGINE	**Neutral Grounding :**	Low Resistance
Coupling:		**Shaft and Diameter:**	
Direction of Rotation at the coupling end:		**Shaft Height:**	
Parallel Operation:	No		
Excitation:	As per specification	**Cooling Method:**	CACA
Automatic Voltage Regulation:	Yes	**Heating Class:**	
Fire Protection:		**Maximum Permissible Voltage Dip.:**	15%

TYPE		
Protection:	IP 55	(In accordance with IEC 529)
Gas Explosing Proofing:		(In accordance with IEC 79.1)
Subdivision (A, B or C):		(In accordance with IEC 79.1)
Temperature (T1 to T6):		(In accordance with IEC 79.1)
Enhanced Safety:		(In accordance with IEC 79.7)
Internal Overpressure:		(In accordance with IEC 79.2)

STATOR				
Casing Orientation (H or V):	Horizontal		**Bearing Type:**	Ball / Roller
Mounting:	SKID		**Prestressed Rolling:**	
Insulation Class:	F		**Smooth:**	
Winding Connection:	STAR	4 wire	**Insulated:**	
Temperature Detectors:	YES	(PT-100 Type)	**Anti-Condensation Heater:**	Yes @ 230 V AC

ROTOR			
Winding Meterial:	Copper	**Cooling Method:**	CACA
Insulation Class:	F		

EXCITATION					
Separate Exciter:	Brushless Type	**One end of Shaft:**		**Exciter Insulation Class:**	F
Solid State Excitation:		External:		Rotating Diodes:	

SAFETY DEVICES								
Alternator Reverse Power:	■	Yes	☐	No	■	Alarm	☐	Shutdown
Alternator Earth Fault:	■	Yes	☐	No	■	Alarm	☐	Shutdown
Short Circuit	■	Yes	☐	No	■	Alarm	■	Shutdown
Over / Under Voltage	■	Yes	☐	No	■	Alarm	■	Shutdown
Overload	■	Yes	☐	No	■	Alarm	■	Shutdown
Alternator Winding Temp. High:	■	Yes	☐	No	■	Alarm	☐	Shutdown
Alternator Phase Unbalance:	■	Yes	☐	No	■	Alarm	☐	Shutdown
Alternator Overcurrent:	■	Yes	☐	No	■	Alarm	☐	Shutdown
Other:	See Specification							

TERMINAL BOXES			
Type:	IP 65	**Position seen from Alternator end (Right, Left or Top):**	
Input:	Cable Glands (Brass)	**Cable:**	Flexible
Outside Diameter:	**Dia. On armour:**	**Dia. Under armour:**	

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
ZISHAN ENGINEERS (PVT.) LTD.	151-6-DSE-004		0	29-01-2019
Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
ATTOCK PETROLEUM LIMITED	MAK	MMM	NAK	6 OF 7

SYNCHRONOUS ALTERNATORS

IDENTIFICATION PLATE				
Metal:	316L Stainless Steel			
TESTS				
Tests:	As per Specification			
MANUFACTURER's DATA				
Name:				
Alternator Type/Model:				
Rated Power (kW):				
Rated Power (kVA):				
Cos Phi (Power Factor):				
Rated Current:				
Allowable Overload(%):				
Efficiency at Cos Phi = 1 at Full load:	3/4 Load:	1/2 Load:	1/4 Load:	
Efficiency at Cos Phi = 0.8 at Full load:	3/4 Load:	1/2 Load:	1/4 Load:	
Voltage Regulator Type:				
Bearings Make & Type:		Lubricant:		
REACTANCES				
Synchronous:	**Longitudinal (Xd):**		**Tranverse (Xq):**	
Transient:	**Longitudinal (X'd):**		**Tranverse (X'q):**	
Subtransient:	**Longitudinal (X''d):**		**Tranverse (X''q):**	
Negative Sequence Reactance (X_2):				
Zero Sequence Reactance (Xo):				
Resistance per rotor winding:				
TIME CONSTANTS				
Longitudinal transient off-load ($T'd_O$):				
Longitudinal Subtransient off-load ($T''d_O$):				
Tranverse off-load ((Tq_O):				
SHORT CIRCUIT CURRENTS				
Subtransient:	**Transient:**		**Synchronous:**	
Voltage:		Power:		
ENCLOSURE				
Structural Frame:	■ Hot Dip Galvanized Steel	☐ Stainless Steel	■ Powder Paint Coated Sheet Steel	
WEIGHTS				
Stator:		**Control Panels**		
Rotor:				
Flywheel:				
Engine Generator Skid:				
MISCELLANEOUS				
Max. Allowable Unbalance Load:				
Degree of Protection Generator Enclosure:	IP55			
Degree of Protection Control Panel:	IP55			
Degree of Protection of Terminal Boxes:	IP65			
Rated Generator Circuit Breaker	Nominal:	Short Circuit :	KA rms	KA peak
Engine-Generator Skid Dimensions	Length	Width	Height	

Project	Electrical Data Sheet			
PORT QASIM BULK OIL TERMINAL PROJECT	Diesel Engine Generator Set (G-03)			
Consultant	**Document No.**		**Revision**	**Date**
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Client	**Prepared By**	**Checked By**	**Approved By**	**SHEET**
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GENERATOR CONTROL AND AMF PANEL

AMF PANEL : As per specifications 193-1-SPE-009

Type:	■	Multiple Breaker	☐	Single Breaker		
Mounting:	■	Floor mounted	☐	Wall mounted		
Enclosure:	■	NEMA 3R	☐	NEMA 1	■	Powder Paint Coated Sheet Steel
Breaker Rating:	**Utility:**		**Generator:**	Vendor to specify		
Interrupting rating / Breaking Capacity:	30kA					
Modes of operation:	■	Emergency/Standby	■	No load Test		
Cable entry:	■	Bottom	☐	Top	☐	Side
System Start Method:	■	Local operator interface	■	Remote contact closure	■	Auto on utility failure
	☐	Time based				
Neutral bus	■	Full rated	☐	Half rated		
Generator Protective Relays:	■	Over / under voltage	■	Over / under frequency	■	Reverse Power
	■	Over / under voltage	■	Over / under frequency	■	Reverse Power
	■	Negative Phase Sequence, Current	■	Negative Phase Sequence, Voltage		

DOCUMENTATION / DRAWINGS

List of Deviations from the Specification

Statement of Compliance

Dimensional Drawing of the Engine/Generator Combination

Dimensional Drawing of Control Panel, Engine Panel, AMF Panel

Schematic Diagrams

Details on Protection Relays, with recommended settings

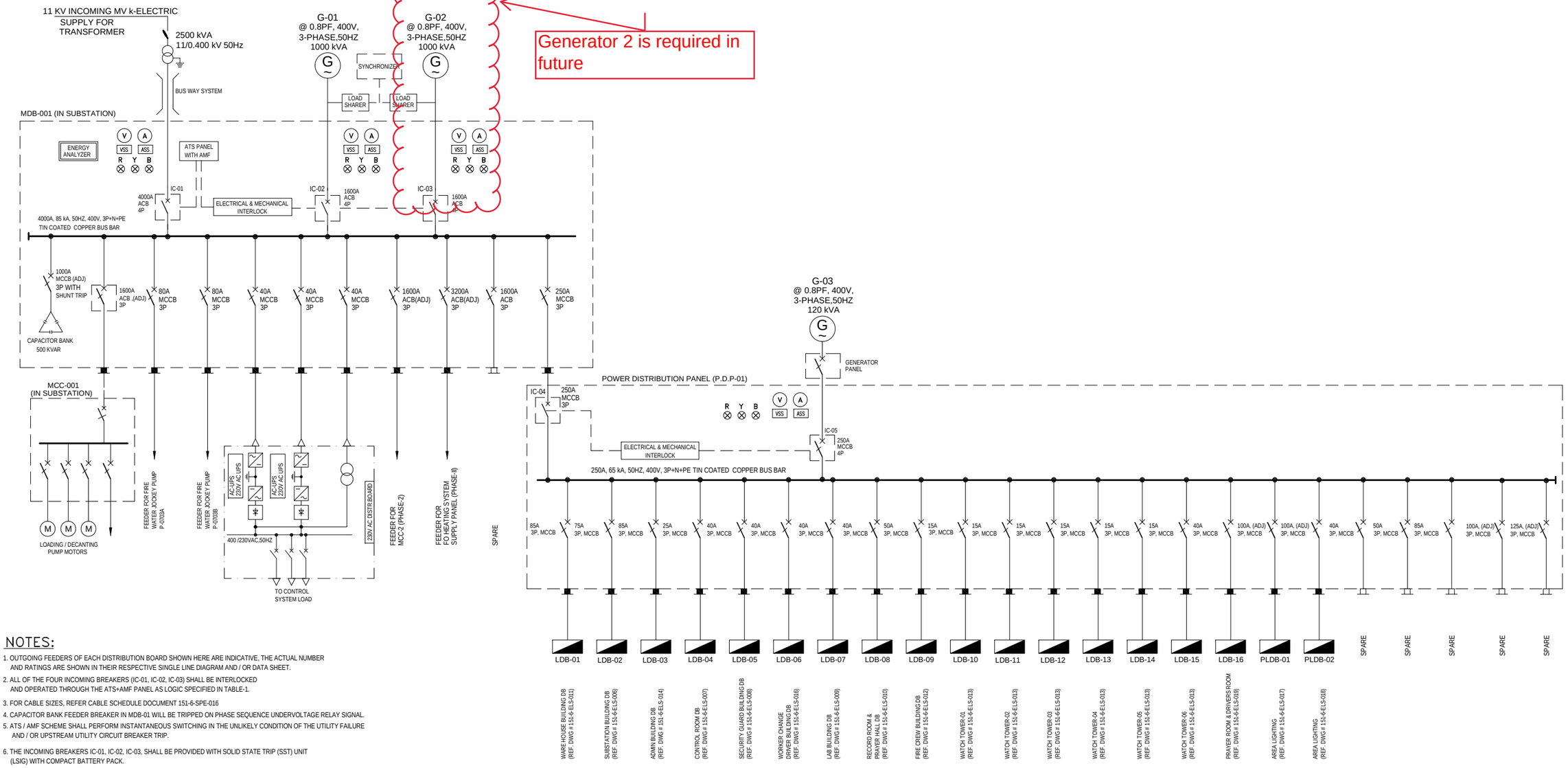
Details on Local or Regional Service Organization for Both Engine and Generator.

OBSERVATIONS

Notes:

1. Supplier shall fill-in all the missing information in the data sheets and submit with bid.
2. Control Panel will have Start stop buttons, start / stop indications, silencing and testing buttons.

DRAWING



NOTES:

1. OUTGOING FEEDERS OF EACH DISTRIBUTION BOARD SHOWN HERE ARE INDICATIVE, THE ACTUAL NUMBER AND RATINGS ARE SHOWN IN THEIR RESPECTIVE SINGLE LINE DIAGRAM AND / OR DATA SHEET.
2. ALL OF THE FOUR INCOMING BREAKERS (IC-01, IC-02, IC-03) SHALL BE INTERLOCKED AND OPERATED THROUGH THE ATS+AMF PANEL AS LOGIC SPECIFIED IN TABLE-1.
3. FOR CABLE SIZES, REFER CABLE SCHEDULE DOCUMENT 151-6-SPE-016
4. CAPACITOR BANK FEEDER BREAKER IN MDB-01 WILL BE TRIPPED ON PHASE SEQUENCE UNDERVOLTAGE RELAY SIGNAL.
5. ATS / AMF SCHEME SHALL PERFORM INSTANTANEOUS SWITCHING IN THE UNLIKELY CONDITION OF THE UTILITY FAILURE AND / OR UPSTREAM UTILITY CIRCUIT BREAKER TRIP.
6. THE INCOMING BREAKERS IC-01, IC-02, IC-03, SHALL BE PROVIDED WITH SOLID STATE TRIP (SST) UNIT (LSIG) WITH COMPACT BATTERY PACK.
7. THE UNDER VOLTAGE / OVERVOLTAGE (27 & 59) & EARTH FAULT PROTECTION (50N/51N) TO BE CONFIGURED IN THE SST (LSIG) UNIT OF THE INCOMING BREAKER LV ACB (IC-01) OF MDB-001.
8. THE LV ACB (IC-01) SHALL BE INTERLOCKED VIA HARDWIRED INTER-TRIP WITH THE RESPECTIVE UPSTREAM VCB OF THE DISTRIBUTION TRANSFORMER. THE INTER-TRIP SENT SHOULD BE THROUGH 86 CONTACT WHILE RECEIVED TRIPPING SHOULD BE THROUGH 94 RELAYED CONTACT.
9. THIS DRAWING SHALL BE READ IN CONJUCTION WITH RELEVENT SPECIFICATION AND DATA SHEET.
10. AMF + ATS PANEL / ACB'S SHOULD INCLUDE SUITABLY SIZED BATTERY BANK FOR ITS CONTROL SUPPLIES TO ACTIVATE AUTOMATIC TRANSFER / SWITCHING OF POWER TO DG SET UPON UTILITY POWER FAILURE / OUTAGE.
11. THE CONTROL VOLTAGE SHALL BE 230 VAC THROUGH CONTROL POWER TRANSFORMER (CPT). EACH STARTER ARRANGEMENT SHOULD BE PROVIDED WITH DEDICATED CPT UNIT.
12. VENDOR SHALL ALSO PROVIDE ADEQUATE NUMBER OF TERMINALS FOR INTERNAL WIRING ALONG WITH 20% SPARES.
13. ELECTRONIC PROTECTION MODULE SHALL BE PROVIDED ON EACH INCOMING MODULE CIRCUIT.

CASE–I NORMAL OPERATION

ALL LOADS MENTIONED WILL BE PROVIDED THROUGH THE UTILITY SUPPLY AND GENERATORS SHALL REMAIN NON-OPERATIONAL.

CASE–II UTILITY FAILURE DURING PLANT OPERATION (DAY TIME)

ON FAILURE OF UTILITY SUPPLY DURING PLANT OPERATION, AUTO MAIN FAILURE + AUTO TRANSFER SWITCH WILL AUTOMATICALLY START THE MAIN STANDBY GENERATOR (G-01) AND ALL THE LOAD WILL BE TRANSFERRED TO G-01, G-02 WILL ALSO START AS PER LOAD REQUIREMENT WHICH WILL BE SYNC WITH G-01.
** IC-03 WILL BE OPERATED AS PER PREVALENT LOAD DEMAND REQUIRING 2nd GENSET OPERATION.

CASE–III UTILITY FAILURE WHEN PLANT IS NOT IN PRODUCTION

ON UTILITY FAILURE WHEN PLANT IS NOT IN OPERATION ONLY ESSENTIAL LOAD WILLL BE FED BY G-03 WHICH WILL BE MANUALLY STARTED. INTERLOCKING BETWEEN IC-05 AND IC-04 WILL ENSURE THAT IN CASE OF G-03 OPERATION, ONLY ESSENTIAL LOADS ARE FED, THEREBY AVOIDING OVERLOADING AND EVENTUAL TRIPPING OF G-03.
*IC-02 CAN BE OPERATED MANUALLY IF ANY MOTOR LOAD NEED TO BE POWERED ON. SO G-01 AND G-02 WILL BE OPEREATED SIMULTANEOUSLY ON DIFFERENT BUSBARS.

ISSUED FOR CONSTRUCTION

INTERLOCKING LOGIC. (TABLE-1) SEE NOTE-3

OPERATING CONDITIONS	IC-01	IC-02	IC-03	IC-04	IC-05
NORMAL OPERATION	✓	×	×	✓	×
UTILITY SUPPLY FAILURE DAY TIME	×	✓	✓**	✓	×
UTILITY SUPPLY FAILURE NIGHT TIME	×	—*	—*	×	✓

✓ = CLOSE POSITION
× = OPEN POSITION

L E G E N D	
SYMBOLS	DESCRIPTION
	DISTRIBUTION BOARD
	POWER FACTOR IMPROVEMENT(PFI) UNIT
V VSS	VOLTMETER WITH VOLTAGE SELECTOR SWITCH
A ASS	AMMETER WITH AMPERE SELECTOR SWITCH
R Y B	INDICATION LIGHTS

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHECKED	APPR.
0	08-02-2019	ISSUED FOR CONSTRUCTION	MSR	MAK	NAK

CLIENT.

Attock Petroleum Limited

Zishan Engineers (Pvt.) Ltd.
An ISO 9001-2015 certified company
47/F Block 6, PECHS, Karachi-Pakistan
Tel: (92-21) 34393045-48, & 34310151-54, Fax: (92-21) 34533430 & 34510156
E-Mail: contact@zishanengineers.com Website: www.zishanengineers.com

DWG. NO. 151-6-ELS-001
REV. 0

JOB NO. 151-6

PROJECT : PORT QASIM BULK OIL TERMINAL PROJECT

TITLE : SINGLE LINE DIAGRAM FOR MAIN DISTRIBUTION BOARD-01 & PDP-01 IN SUBSTATION LV ROOM

SIZE	SCALE	SHEET
A1	N.T.S	1 OF 1