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DIVISION 1: INSTRUMENT LANDING SYSTEM (CAT-I: ILS)

PART 1 – DESCRIPTION

1.1 SCOPE

This specification sets forth the performance requirements and technical characteristics of a complete Category 1 Instrument Landing System (ILS) including the associated ancillary items. DOTC, hereinafter referred as “the Owner”, is the issuing authority of this SRS.

1.2 REFERENCE

A. THE RULES AND REGULATIONS OF THE REPUBLIC OF THE PHILIPPINES

B. ICAO DOCUMENTS

Annex 10 Volume I Aeronautical Telecommunications
ICAO Doc. 8071 Volume 2 Flight Testing Procedures

C. US GOVERNMENTS SPECIFICATIONS

FAA-STD-003 Paint Systems for Structures
FAA OA P 8200.1 United States Standard Flight Inspection Manual

D. OTHER DOCUMENTS

EIA Standard RS-222 Structural Standards for Steel Antenna Tower and Antenna Supporting Structures

RTCA Documents DO-178B Software Consideration in Airborne Systems and Equipment Certification

DO-216 General Specifications for Ground Based Electronics Equipment

1.3 ABBREVIATIONS

When the following abbreviation/acronyms are used in this specification, they have the following meanings.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AC</td>
<td>Alternate Current</td>
</tr>
<tr>
<td>APCU</td>
<td>Amplitude &amp; Phase Control Unit</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATCT</td>
<td>Air Traffic Control Tower</td>
</tr>
<tr>
<td>CAT</td>
<td>Category</td>
</tr>
<tr>
<td>CAAP</td>
<td>Civil Aviation Authority of the Philippines</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DDM</td>
<td>Difference in Depth of Modulation</td>
</tr>
<tr>
<td>DME</td>
<td>Distance Measuring Equipment</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>ERP</td>
<td>Effective Radiated Power</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration, USA</td>
</tr>
<tr>
<td>FFM</td>
<td>Far Field Monitor</td>
</tr>
<tr>
<td>GP</td>
<td>Glide Slope</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument Flight Rules</td>
</tr>
<tr>
<td>ILS</td>
<td>Instrument Landing System</td>
</tr>
<tr>
<td>KHz</td>
<td>Kilohertz</td>
</tr>
<tr>
<td>LCSU</td>
<td>Local Control Status Unit</td>
</tr>
<tr>
<td>LLZ</td>
<td>Localizer</td>
</tr>
<tr>
<td>LPDA</td>
<td>Log-Periodic Dipoles Array</td>
</tr>
<tr>
<td>LRU</td>
<td>Line Replaceable Unit</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MPH</td>
<td>Miles Per Hour</td>
</tr>
<tr>
<td>MPMT</td>
<td>Mean Preventive Maintenance Time</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failure</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time To Repair</td>
</tr>
<tr>
<td>NDI</td>
<td>Non-Developmental Items</td>
</tr>
<tr>
<td>NM</td>
<td>Nautical Mile</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
</tr>
<tr>
<td>PIR</td>
<td>Portable ILS Receive</td>
</tr>
<tr>
<td>PISA</td>
<td>Portable ILS Signal Analyzer</td>
</tr>
<tr>
<td>RCSU</td>
<td>Remote Control Status Unit</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
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</table>
1.4 PROPOSAL FOR PRODUCTS TO BE FURNISHED

The Owner intends to have CAT I ILS established for the Laguindingan Airport for Runway 09-27, IFR operations. ILS system shall consist of LLZ, GP and DME using instead of Marker Beacon System, System Monitoring and Control Equipment and other necessary subsystems. All the equipment shall be dual (main and standby) except for physically impossible components. Local control unit, Antenna Distribution unit combining monitoring unit and system changeover unit.

The Contractor’s proposal shall include the description of the products that meet or exceed the performance requirements specified in this specification. The physical configuration of the proposed system may differ from the description in this specification but the performance requirements shall be met. If the proposed configuration does differ from requirements in this specification, the proposal shall contain technical data and the rational to provide sufficient information that all performance requirements are met or exceeded.

The Proposal shall also include a listing of all components including the quantity per item for one (1) ILS to be established for Laguindingan Airport, with reference to Paragraph 1.5 bellow. The Proposal, in addition, shall include a listing of all tools, test equipment, technical manuals, spare parts and training plans necessary for the operation and site maintenance of the systems to be established.

The technical proposal shall be organized in the same order and numbered in the same way as this specification, and be accompanied with photos, drawings, etc. as appropriate and a duplicate of typical as-built technical manuals as necessary so that the Owner can fully understand the contents of the proposal. When the proposed products have different characteristics (improvements) from what this specification requires, the Contractor shall highlight the corresponding part of the proposed equipment by underlined and bold-type letters in order for the Owner to review the differences easily.

If the Contractor fails to respond appropriately to this System Requirement Specifications such as failure to provide photos, diagram or description of the performance requirements, etc., so that it is very hard for the Owner to make a judgment, he will be deemed to have no intention to bid, and may be evaluated as non-responsive to the technical requirements.
1.5 ITEMS AND QUANTITIES TO BE FURNISHED BY THE CONTRACTOR

The Contractor shall provide all the items necessary to establish and operate one CAT 1 ILS. The table below is intended to provide references to the Contractor for developing his technical proposal.

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Qty</th>
<th>Refer to</th>
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<td>VHF Localizer and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.1</td>
</tr>
<tr>
<td>2</td>
<td>DME and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.3</td>
</tr>
<tr>
<td>3</td>
<td>UHF Glide Slope and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.4</td>
</tr>
<tr>
<td>4</td>
<td>LLZ, FFM and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.2E</td>
</tr>
<tr>
<td>5</td>
<td>System Monitoring and Control and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.6</td>
</tr>
<tr>
<td>6</td>
<td>Portable ILS/DVOR Field Test Set (FTS)</td>
<td>1 Lot</td>
<td>Para. 2.7</td>
</tr>
<tr>
<td>7</td>
<td>Instruction Books</td>
<td>5 Ea</td>
<td>Para. 2.8A</td>
</tr>
<tr>
<td>8</td>
<td>Site Test Equipment and Tools</td>
<td>1 Lot</td>
<td>Para. 2.8B</td>
</tr>
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<td>9</td>
<td>Site Spare Parts</td>
<td>1 Lot</td>
<td>Para. 2.8C</td>
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1.6 GENERAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION

The requirements specified in the following subparagraphs are extracted from RTCA DO-216 with some modifications to satisfy the needs of the Owner, and shall be applicable to the entire ILS unless otherwise indicated.

For the items specified in RTCA DO-216, but not specified below, RTCA DO-216 shall be applied.

A. EQUIPMENT PHYSICAL DESIGN

The equipment shall be designed in such a manner as to facilitate the accomplishment of the testing, adjustments and maintenance operations.

1. Equipment Cabinets

The LLZ and GP (including DME) equipment shall be housed in an enclosed cabinet. The cabinets shall include appropriate provisions for ventilation and a meter indicating operating status and operating hours (both main and standby). Cabinet material shall be durable and non-corrodable. The thickness of the material and method of forming and reinforcing shall be such as to result in a rigid assembly capable of supporting all of the equipment while in a fully open condition without twisting or warping the cabinet. The cabinet shall be floor mounted.
2. Front Panels

Front panels shall be of a uniform thickness with sufficient strength to support attached components and to withstand repeated openings without deformation. When blank panels are required to fill empty spaces in the equipment cabinet, they shall be of the same material and thickness as the equipment front panels.

3. Equipment Unit Construction

Major assemblies or Line Replaceable Units (LRU) shall be designed to be completely removable from their enclosures without disassembly. Access shall be provided to modules or subassemblies from outside the basic equipment from the front of the equipment or through the use of swing-out chassis, pull-out drawers with mounting slides or similar means. If slides are used, they shall be heavy duty, full suspension roller type drawer slides capable of supporting the weight of the equipment without bending, bowing or coming out of track. The slides shall be provided with latching stops to limit the travel of chassis to that sufficient for complete access to all components, and by intentional unlatching of the stops, to permit complete removal of the chassis from the cabinet. Photo of the cabinet and that of each unit must be submitted so that the Owner can see the configuration or location of the proposed modules, cards and sub-assemblies.

B. ADJUSTMENTS

The ILS shall be designed such that all transmitter, monitor and control adjustment essential for proper operation and maintenance and all indicators shall be accessible via the RMM unit and/or appropriate local display unit.

1. Adjustment display

A portable terminal connected to the RMM monitor shall be capable of displaying all control settings on a neatly formatted screen or screens. For purposes of making adjustments, parameters will be selectable by cursor, menu, or by an alphanumeric code. For a system which requires operator input to make adjustments, on-screen help shall be provided. Any device or feature that facilitates the adjustments by providing diagrams and/or descriptions must be presented.

2. Adjustment storage

Electronically entered control settings must be stored automatically or by operator’s input, into non-volatile memory storing for at least 90 days, either immediately upon entry and/or at the conclusion of an adjustment/maintenance operation.
C. INTERIOR EQUIPMENT FINISHES

The surface of all FRP cabinet and all panels, shelves, draws and enclosures of the LLZ and GP (including DME) equipment cabinets shall receive one or more uniform spray coats of semi-gloss enamel after the prime coat. The color of the final coat will be selected by the Owner. The finish provided will be baked to a hard durable surface.

D. EXTERIOR EQUIPMENT FINISHES

The LLZ antenna supports, GP antenna tower (including DME), FFM antenna support and equipment shelter to be furnished by the Contractor shall be painted in an obstruction marking configuration in accordance with Owner’s choice. Paint quality and the finish shall be in accordance with FAA-STD-003, or equivalent industry standard, and shall be capable of withstanding a safety environment.

E. ELECTROMAGNETIC INTERFERENCE CONTROL

Each subsystem shall be designed so that the mean power of spurious RF emission to the antenna transmission line shall be not less than 60 dB below the mean power of the fundamental. With each transmitter terminated into a dummy load or a properly terminated cable, the stray radiation on the frequency from the equipment under any operating condition shall not exceed 5.0 micro-watts effective radiated power (ERP).

F. TEST POINTS, CONNECTORS & FAULT DIAGNOSTICS

Each line replaceable unit (LRU) of the ILS equipment shall contain test points and connectors appropriately labeled and numbered to provide for the examination of essential voltages, signal amplitudes, wave forms and timing characteristics and to provide for the connection of test equipment for troubleshooting, adjustment and maintenance operations. Units employing micro-processors shall be provided with a diagnostic routine capable of locating the cause of any failure to at least the LRU.

The diagnostic routine shall be executed automatically upon application of power, and if unsuccessful, the results shall be transmitted to the site display unit or the central monitoring point as a diagnostic alarm message. If a portable terminal is connected to the subsystem terminal interface, the alarm message shall be transmitted to the portable terminal. In addition, it shall be possible to initiate the diagnostic routine from the subsystem terminal interface, or the central point. Fault diagnostics item, characteristics and function, must be provided.

G. RESET SWITCH

Each subsystem of the ILS that employs microprocessors shall have a front panel mounted, momentary contact switch labeled “RESET”. Activation of the reset switch shall cause all program variables and all software/firmware controlled hardware to the initialized condition from which normal program execution can continue.
H. TRANSMITTER RF POWER SAMPLING

Means shall be provided to measure forward and reverse RF powers, with an accuracy of ±5%, for each ILS transmitter.

I. TEST METER

A meter or other indicator shall be provided to allow convenient monitoring of functional parameters required for initial equipment tune-up, preventive and corrective maintenance.

J. LOCAL STATUS INDICATORS

Each subsystem shall be provided, as a minimum, with indicator lamps to indicate operational status as follow:

1. Station normal (green)
2. Monitor alarm (red)
3. Monitor alarm by-pass (amber)

K. SPARE PARTS, TEST EQUIPMENT AND TOOLS

All spare parts, test equipment and tools required to operate and maintain the ILS equipment shall be provided in accordance with paragraph 2.8 of the SRS as a minimum. In addition, a convenient means of mounting or storing the tools or cables shall also be provided.

L. VOLTAGE REGULATORS

Voltage regulation in the equipment shall be provided (if required) by means of voltage or current regulators, or both, in the DC output circuit of the power supplied.

M. ANTENNA SUPPORT MATERIAL AND DESIGN

The localizer far field monitor antenna support and the glide slope antenna support shall be self supporting steel towers. The localizer antenna supports shall be of frangible aluminum self supporting construction (see paragraph 2.2.B.7 of this specification). The design, manufacture and workmanship, factory finish, plans and markings, foundation designs and protective grounding for metal towers and supports shall be in accordance with EIA Standard RS-222, and FAA-STD-019, or equivalent commercial standards.

Submit plan to prevent deleterious foundation settlement at the location where the ILS shelters and antennas will be installed.

Submit all the design, calculations and drawings for the installation of the antennas with the specifications for installation of metal towers.
N. PROTECTIVE ENCLOSURE FOR MONITOR ANTENNAS

Protective enclosures for monitor antennas (near field/far field), localizer and glide slope shall be provided to prevent birds, insect, and rain from coming in contact with the antenna elements. A complete description protective enclosure design, material used effectiveness with drawing and photos must be provided.

O. TRANSIENT PROTECTION

The equipment shall be protected against damage or operational impairment due to induced transient currents on any ungrounded power lines, communication, control, signal or monitor line entering or leaving the subsystem or equipment shelter or ancillary unit. Transient protection shall be provided in accordance with paragraph 3.1.2.7.1 of RTCA Specification Do-216.

In addition to the above, the Contractor may nominate other effective techniques for protection of the external transient.

P. ENVIRONMENTAL SERVICE CONDITIONS

1. For equipment installed in an equipment shelter:

The environmental service conditions required for equipment installed in an equipment shelter such as LLZ, GP, DME and FFM, shall be as follows:

   a. Temperature : -10° to +50°
   b. Relative humidity : to 95% (non-condensing)

2. For equipment installed outdoor

The environmental service conditions required for equipment installed outdoors (such as LLZ, GP, DME and Field detectors, etc.) shall be as follows:

   a. Temperature : -50° to +70°
   b. Relative humidity : 100%
   c. Wind speed : up to 161km per hour (100MPH)
   d. Altitude : To 15,000 ft MSL (45,000 ft)

3. For equipment installed in attended facility:

The environmental service conditions required for equipment installed in an attended equipment room or operation room shall be as follows:

   a. Temperature : +10° to +45°
Q. PRIMARY POWER

The Primary Power of the Laguindingan Airport will be 220 V AC, 60Hz, three phase. The ILS system to be furnished shall be designed and fabricated to fit the primary power requirements mentioned above. All the utility outlets for all subsystems and test equipment will be supplied from 220V AC supply. All equipment shall be operated with DC power supply.

R. STANDBY POWER

The ILS subsystems shall operate using a continuously charged DC battery power supply system which will support a continued, uninterrupted normal operation in the event of a main power failure. The Contractor shall state his strategy for operating uninterrupted power for all systems (LLZ, GP, DME, etc). The Proposal shall contain the minimum running time using the proposed battery power source when mains supply is removed, including the critical battery discharge point for each facility type, the time required for self-restore capability to recharge flat batteries up to 100%, and where and how to install the battery packs.

The ILS remote monitoring and control unit, and remote status, if separately powered, shall include a standby battery. The battery shall include an automatic recharge circuit and the battery shall provide at least two hours of operation upon failure of a primary power.

When primary power is restored, the state of the battery shall in no way cause harm to or affect the operation of the respective subsystems.

S. LIGHTNING SURGE PROTECTION

The internal and external lightning surge protection system to be provided by the Contractor must meet the best industry standards. The Contractor shall also be required to submit an analysis report on the coverage of the lightning surge protection system.

T. MAINTAINABILITY

1. System Configuration

The Contractor shall submit a summary statement with procedures and schematic drawings for routines to provide easy preventive maintenance, which will allow rapid and accurate trouble shooting, repair and economies for flight inspections.

2. Corrective Maintenance Requirements

The Contractor shall state his Mean Time to Repair (MTTR). The repair time specified shall include diagnostic time, disassembly and removal of the failed LRU(s), replacement and installation of the new LRU(s) including
any adjustments data loading necessary to initialize the LRU(s) and all adjustment required to return the ILS to normal operation.

3. Preventive Maintenance Requirements

The mean preventive maintenance time (MPMT) of the maximum electronic equipment configuration for the ILS localizer subsystem (including DME) shall not exceed ten (10) hours in 90 days of operation.

The MPMT for the complete Glide Path subsystem shall not exceed ten (10) hours in 90 days of operation.

The MPMT for any Localizer and Glide Path monitoring subsystem shall not exceed five (5) hours during 90 days of operation.

The MPMT for the remote monitoring and control equipment shall not exceed five (5) hours during 180 days of operation.

The MPMT includes all of the time required to complete the routine checks and inspections necessary to assure normal operation. Ninety-five percent of all routine procedures required for ILS shall be accomplished in less than 15 minutes. No signal group of periodic procedures shall require more than two (2) hours completing it.

For validation of the proposed MPMT by Owner, the Contractor may submit a copy of an official letter of certification or verification issued by FAA or equivalent authority for the proposed system. It may be included in the technical proposal.

U. RELIABILITY

The Contractor shall qualify, through demonstration and calculations, using a serial reliability model, the system reliability figures and Mean Time Between Failures (MTBF) for each ILS subsystem or equipment group as specified below. Reliability predictions shall be in accordance with paragraph 3.2.3.4 of RTCA Specification DO-216 and be stated in the following format.

1. Localizer ; ≥ 10,000 hours
2. Glide Path ; ≥ 10,000 hours
3. Localizer far field monitor ; ≥ 10,000 hours
4. Remote indication and control equipment ; ≥ 10,000 hours
5. Line Control unit ; ≥ 10,000 hours
6. Portable ILS Receiver ; ≥ 10,000 hours

This model shall not include terminals, modems, telephone lines, or any other interface circuitry.
For reliability validation by the Owner, the Contractor shall provide an official test report with data conducted by FAA or equivalent international agencies.

V. SOFTWARE

Software for the ILS system shall be developed using the RTCA document DO-178B, “Software Considerations in Airborne Systems and Equipment Certification” or an equivalent certification standard.

1.7 OBSERVANCE OF THE CONTRACTOR

This paragraph contains additional information on administrative and contractual terms and conditions.

1. The Contractor shall provide qualified engineers or technicians during equipment, adjustment, calibration, test, fault isolation, repair, ground support of flight test and data collection.

2. The Contractor shall provide air transportation, lodging, local vehicle, international telephone fee, correspondence and subsistence requirements of the Contractor's engineers or technicians.

3. The Contractor shall be responsible for the safety of personal and shall be held responsible for accidents which may occur during the period of this project.

4. The Contractor shall have the full responsibility for the adjustment, testing, alignment, recovery or replacement of loss and damage to all equipment.

5. The Contractor shall consult the Owner in case of the contradiction or anything not mentioned in this specification.

A. ACCEPTANCE TEST

1. FACTORY ACCEPTANCE TEST (FAT)

The test shall be carried out at the Contractor’s factory and on his responsibility in the presence of the Owner’s representatives. These shall consist of visual inspections, operation tests, insulation resistance tests, withstand voltage test, earthing test, ratio tests, etc. in accordance with the manufacture’s standards.

The Contractor shall bear the cost of transportation of the Owner’s representatives and Consultant’s Air Navigation Specialist from/to their hotel, from/to Philippines by regular fare including local transportation from the hotel to the factory site. The Contractor shall also bear the cost for the hotel accommodation and food as well as daily expenses covered by payment of US Dollars 300 per diem by the Contractor to each person. Expenses to be incurred for the two (2) Owner’s representatives and one (1)
Consultant’s Air Navigation Specialist spending ten (10) days of stay (inclusive of travel time) shall be included in the proposal.

2. **SITE ACCEPTANCE TEST (SAT)**
   
a. The SAT procedure is a series of tests to be carried out by the Contractor and witnessed by the Owner. These tests shall be performed to verify the optimum performance of the entire system in accordance with the requirements outlined in the technical specifications of this document and shall include precise tests and evaluations of installation status, performance and operation status.

   b. If any part of the site acceptance test is declared unsatisfactory by the Owner’s, representative, acceptance will not be possible. When the amount of work comes up to the standard in accordance with the installation procedures, acceptance will be accomplished.

3. **DATA PREPARATION FOR ACCEPTANCE TEST**

   The Contractor shall prepare items to be checked and tested for the SAT and shall submit three (3) copies of the data to the Owner not later than two (2) weeks before the start date of the SAT. Data to be prepared shall include the following items:

   a. Site acceptance test time schedule.

   b. Check list and formats for the SAT.

   c. SAT procedures.

   d. Technical and software documentations.

   e. Test equipments, tools and spare parts.

4. **CHECK LIST AND FORMATS FOR SAT**

   The check lists and formats for the test shall include the following items:

   a. Objective of each test.

   b. Status of subsystem prior to each test.

   c. Reference value or result to be expected of each test.

   d. Actual test value or result during the SAT.

   Any alignment or remedial action taken during the SAT.

5. **SAT PROCEDURES**

   The acceptance test shall be executed in accordance with the procurement specification and Contractor’s proposal including the following items:
a. Examine whether all the necessary equipment are perfectly installed.

b. Examine whether all the important system parameters and the related functions are tested.

c. Quantity inspection.

d. Flight check is completed.

B. UNSATISFACTORY SAT

1. Should any part of the site acceptance test be declared unsatisfactory by the Owner, the Contractor shall replace the disqualified part or component by satisfactory one. The replacement shall be carried out until the completion date of the equipment installation.

2. In case that a replacement is exceeded completion date, the Contractor shall compensate the Owner for all damages according to the related laws and ordinances.

3. The Contractor shall submit a report to the Owner describing the exact cause and remedial action taken for the unsatisfactory test item.

1.8 EDUCATION AND TRAINING

The Contractor shall be responsible for ILS and DME education and training for Owner’s staffs for both Contractor's factory training and on-site training (On-the-job training). The Contractor shall prepare necessary education materials and training aids. All training shall be conducted in the English language and the Contractor shall submit the curriculum and training schedule at least, two (2) months before the training start date.

A. FACTORY TRAINING

1. The Contractor shall provide training for four (4) Owner’s staffs at the manufacturer's factory. The training course shall be designed to bring up the trainees to a sufficient level for the proper operation and maintenance of the proposed system. The training period of LLZ, GP and DME shall be for a minimum of six (6) weeks. The Contractor shall provide the round-trip airfare, training fees, education materials, official trip expenses (Hotel fee, meals, daily allowances), etc. Official trip expenses shall be provided in accordance with the Guidelines of the Civil Service Commission of the Philippines.

2. The training shall be planned to be completed within one (1) month before the starting of equipment installation.
3. The Contractor shall be responsible for providing transportation facility during the training period on site.

B. ON THE JOB TRAINING

During the on-site shake down test period, the Contractor shall provide on-the-job training for the theory of operation, preventive maintenance procedure, detailed alignment procedure and trouble-shooting techniques of the system. On-the-job training shall be conducted to improve the proficiency level of maintenance staff. Instruction for preventive and corrective maintenance procedures shall be conducted individually for each system with introductions to block diagram and schematic diagram analysis.

The number of trainees and training periods that the Owner required for the on-the-job training courses are as follows.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Weeks</th>
<th>Number of Trainees</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILS/DME</td>
<td>4</td>
<td>at least 5</td>
<td></td>
</tr>
</tbody>
</table>

C. REQUIREMENT OF FACTORY TRAINING COURSE

All training courses shall include separate chapters for theory and practice, hardware and software. After completion of the training, trainees shall be able to isolate and restore defective hardware modules or cards, and fully understand the architecture of hardware and analysis of operating system and application software.

1.9 DOCUMENTATIONS

The Contractor shall provide technical manuals and related documents written in the English language.

A. QUANTITIES OF REQUIRED DOCUMENTS

1. Installation plan and drawings : 3 copies
2. System inspection and test reports : 2 copies
3. Training plan : 1 copy
4. Training manual and materials : 1 set for each trainee
5. Technical manuals : 5 copies for each equipment. (English)

B. TECHNICAL MANUALS

The manuals shall contain the following chapters.

1. General and functional descriptions for each subsystem.
2. Equipment installation procedure and Theory of operation.
3. Preventive maintenance procedures and Corrective maintenance procedures.
4. Trouble-shooting procedures.
5. List of bench stock items with their types, part numbers, and quantities.
6. Parts illustrations and pictures.
7. Block diagrams and detailed schematic diagrams.

1.10 COMMISSIONING FLIGHT TEST AND OPERATIONAL TEST RUN

Radio Navigational Aids shall be subject to Flight Test by the Contractor. This test shall conform to those set out in the ICAO Manual Doc. 8071, Annex 10 and Annex 14. The Contractor will make arrangement for the aircraft and personnel necessary for the flight test. The flight test shall be carried out by the Contractor. In the event of re-testing the flight to be conducted by the Contractor, as a result of any such defects, the Contractor shall make available at the site his personnel who shall witness the initial flight test.

After the commissioning flight test, the Contractor shall perform the operational test run. The Contractor shall take immediate actions required to correct the operational and functional problems that occurred during the operational test run period. All the corrective actions shall be recorded and the records maintained. The recording files shall include the date and time the problem occurred, cause of failure(s) and a brief description of corrective action to be taken. This record shall be submitted to the Owner.

The cost of all personnel, equipment, flight charge, etc., shall be deemed to be included in the Contract Price.

1.11 WARRANTY

The Contractor shall warrant that no system down or performance degradation will be encountered for three (3) years after the date of final acceptance. During the warranty period, the Contractor shall provide materials and technical services without any cost to the Owner. However, the Contractor shall be responsible for equipment problems caused by any design and production faults regardless of warranty period. In case any problem occurs, the Contractor shall replace defective parts of equipment with new parts without any cost or additional compensation for its replacement.
PART 2 – PRODUCT

The Instrument Landing System to be provided under this specification shall meet the requirement of ICAO Annex 10 (Aeronautical Telecommunications for Category I ILS technical specifications) and Philippine Flight Inspection Procedure (FAA OA P 8200.1 and ICAO Doc. 8071).

2.1 VHF LOCALIZER SYSTEM

A. PERFORMANCE REQUIREMENTS

The VHF localizer shall provide guidance in the horizontal plane to aircraft in approaches to and landings at airfields. The radiation from the localizer antenna group shall produce a composite field pattern that is amplitude modulated by a 90 Hz and a 150 Hz tone and 1020 Hz identification tone. The radiation field pattern shall produce a course sector with one tone predominating on one side of the course and other tone predominating on the opposite side. When an observer faces the localizer from the approach end of the runway, the depth of modulation of the radio frequency carrier due to the 150 Hz tone shall predominate on his right-hand side and the depth of modulation of the radio frequency carrier due to the 90 Hz tone shall predominate on the left-hand side. All horizontal angles employed in specifying the localizer field patterns shall originate from the center of the localizer antenna group which provides the signals used in the front course sector.

1. RADIO FREQUENCY

The localizer transmitters shall be capable of operation on 0.05 MHz increments across the band of 108 to 111.975 MHz. The frequency shall not exceed ±0.002 percent over the service conditions. The frequencies of the two RF carriers of the dual frequency localizer shall be individually adjustable or the clearance transmitter frequency shall be locked to the adjustable course transmitter frequency. With all tolerances applied, the frequency separation between the carriers shall not be less than 5.0 KHz or more than 14.0 KHz.

2. COVERAGE

The localizer shall provide a reliable up to 25 NM within 10 degrees either side of the on course, while up to 17 NM for the areas from 10 degrees to 35 degrees either side of the on course, and up to 10 NM for the areas beyond 35 degrees either side of the on course. The strength of the signal shall be met with the criteria specified in paragraph 3.1.3.3.1 of ICAO Annex 10, Volume 1.

3. POLARIZATION

The emission from the localizer shall be horizontally polarized.
4. CARRIER MODULATION

The nominal depth of modulation of the radio frequency carrier due to each of the 90 Hz and 150 Hz tone shall be 20 percent and shall be maintained within the limits of 19 and 21 percent.

5. COURSE ALIGNMENT ACCURACY

Based on a nominal sector width of 213m (700 feet) at threshold, the mean course line shall be adjusted and maintained within limits equivalent to ±10.5m (35 feet) from the runway centerline at the ILS reference datum.

6. DISPLACEMENT SENSITIVITY

The nominal displacement sensitivity within the half course sector at the ILS reference datum shall be 0.00044 DDM/ft, based on a nominal sector width of 213m (700 feet) at the ILS reference datum. The increase of DDM shall be substantially linear with respect to angular displacement from the front course line up to an either side of the front course line where the DDM is 0.180. From that angle to ±35 degrees, the DDM shall not be less than 0.180. When the course is widened sufficiently to cause an alarm, the DDM shall not be less than 0.155 from ±4 degrees to limits of coverage.

7. COURSE SECTOR WIDTH

The localizer sector width shall be tailored to a value of 213m (700 feet) at the runway threshold. The sector width shall be easily adjustable between the values of 2.4 and 7.2 degrees.

8. IDENTIFICATION

The localizer shall provide for the simultaneous transmission of the identification signal on the same radio frequency carrier as used for the localizer function. The transmission of the identification signal shall not interfere in any way with the basic localizer function. The identification signal employ the International Morse Code and shall normally consist of three letters. It shall be preceded by the International Morse Code signal of the letter “I”. The identification signal shall be transmitted at a speed corresponding to approximately 7 words per minute, and shall be repeated at approximately equal intervals, not less than 6 times per minute, at all times during which the localizer is not available for operational use, as for example during removal of navigational components or during test or maintenance, the identification signal shall be suppressed.

9. CONTINUITY OF SERVICE OF THE LOCALIZER SUBSYSTEM

The continuity of service of the localizer subsystem shall be equal to or greater than 1-2x10-6 in any period of 30 seconds.
10. INTEGRITY OF THE LOCALIZER SUBSYSTEM

The integrity of the signal from the localizer subsystem with the FFM subsystem included in the calculations shall each be equal to or greater than 1-2 x 10^-9 in any one landing.

B. COMPOSITION OF VHF LOCALIZER

1. Owner’s Subsystem Concept

A completely equipped VHF Localizer subsystem shall consist of the followings;

a. Dual (main and standby) course and clearance transmitters with associated modulation, control and automatic changeover equipment.

b. Localizer antenna array with associated feed line and integral monitor cabling, strip-line or micro-strip signal distribution units, integral monitor pickup devices and strip-line or micro-strip combining unit, obstruction lights and antenna support structures.

c. Dual (main and standby) localizer monitor group

d. Equipment shelter

e. Remote monitoring and control group including RMM

f. Far field monitor group

2. Deviations and Exceptions to the Above Requirements

If the proposed configuration differs from the above, in order to employ new technology, it shall be stated in the technical proposal in detail for identification and review by the Owner. The following items are primary areas of concern.

a. Reliability and Maintainability

b. Status monitoring and Self-diagnostics

c. Convenience for flight inspection: The flight inspection will be conducted in accordance with Philippine Flight Inspection Procedures (FAA OA P 8200.1 and ICAO Doc. 8071). If there are any functions or features intended to promote the convenience of flight inspection. The Contractor should describe them in detail in his technical proposal, in the same order as the Philippine Flight Inspection Procedures.

d. Transmitter group

e. Monitoring group

f. Antenna assembly group

g. Back-up power supply group
2.2 CHARACTERISTICS FOR MAJOR COMPONENTS OF LOCALIZER

A TRANSMITTER

1. **Transmitter Output Power**

   The transmitter carrier output power shall be adjustable over the range of at least 40 percent to 100 percent of the rate transmitter output power. Adjustment over this range shall not change the modulation balance by more than 0.002 DDM, the course width by more than 2.0 percent, the percentage of identification modulation by more than 10 percent of normal, and carrier modulation by more than ±1.0 percent.

2. **Transmitter Stability**

   After initial adjustment under normal test conditions for optimum transmitter performance, changes over the service conditions shall not exceed the limits tabulated below:
   
   a. Carrier power at carrier output : ±10 percent
   b. Side-band ratio : ±0.5dB
   c. Carrier modulation : ±1 percent (each tone)
   d. Carrier modulation balance : ±0.005DDM
   e. Side-band balance : ±0.3dB
   f. RF phase between carrier and side-band outputs : ±10 degrees
   g. Navigational tone frequency : ±1.0 percent
   h. Identification frequency : 1020Hz ± 50Hz
   i. Transmitter frequency : ±0.002 percent

3. **Stabilization Time**

   After initial adjustment under normal test conditions, the values for the parameters shall be acquired within 0.5 second.

4. **Control Function**

   A switch or control shall be provided to run transmitter output radiation on and off. In addition, it shall be possible to select either locally or remotely.

5. **Crystals**

   Crystals shall be furnished to control course and clearance transmitter output frequencies assigned by the Owner. In lieu of crystals, the transmitter frequency may be controlled by a crystal-referenced synthesizer adjustable over the full frequency range of 108 to 111.975 MHz in steps of 0.005 MHz. The Contractor shall state which option is selected in his technical proposal.
6. **Crystal Oven**

   A crystal oven shall not be used.

7. **Resonance Point**

   There shall be no identification of more than one resonance point over the complete range of travel adjustment for all controls normally used in tuning or adjusting the transmitter to meet equipment specification requirements.

8. **Indicator lights**

   Indicator lights shall be provided to indicate the application of power and local and remote control.

9. **Modulator design**

   The modulator shall provide an output containing the RF carrier modulated by the navigation tones and identification tones and identification tones, and an output containing only the separate side-band frequencies shall be of electronic, solid state design.

10. **Modulating tones for navigation**

    The modulating tones shall be 90Hz and 150Hz within ±1 percent. The depth of amplitude modulation of the radio frequency carrier at the power supply frequency or its harmonics, or by other unwanted components, shall not exceed 0.5 percent. Harmonics of the supply, or other unwanted noise components that may inter-modulate with the 90 Hz and 150 Hz navigational tones or their harmonics to produce fluctuations in the course line, shall not exceed 0.05 percent modulation depth of the radio frequency carrier.

11. **Audio Phase of modulation tones**

    The modulating tones of course and clearance transmitter shall be phase-locked so that it is within the half course sector. The demodulated 90 and 150 Hz wave forms pass through zero in the same direction within 10 degrees of phase relative to the 150 Hz component every half cycle of the combined 90 Hz and 150 Hz wave forms.

    In addition, the 90 Hz modulating tone of one carrier shall be phase-locked to the 90 Hz modulating tone of the other carrier so that the demodulated wave forms pass through zero in the same direction within 10 degrees of phase relative to 90 Hz.

    Similarly, the 150 Hz tones of the two carriers shall be phase-locked so that the demodulated wave form pass through zero in the same direction within 10 degrees of phase relative to 150 Hz.
12. **Carrier modulation**

A control shall be provided to adjust modulation of the carrier output signals over a minimum range of 17 to 23 percent for each navigational tone. Adjustment of this control over its entire range shall not produce a change of more than 5 degrees in RF phase between carrier side-band outputs.

The Contractor shall specify the adjustment procedures and intervals for carrier modulation on his products in his technical proposal.

13. **Side-band amplitude control**

A side-band amplitude control shall be provided to enable adjustment of the localizer course sector width. Adjustment of this control over its range shall not change the carrier to side-band phasing by more than 5 degrees.

14. **RF phase control**

A course and clearance phasing control shall be provided for shifting the RF phase of the signals appearing at the side-band output over a range of at least ±30 degrees from normal. With the complete facility radiating and properly phased, the phase control from the mid-range shall be setting at midrange ±20 percent. Adjustment of this control from the midrange setting over its full range shall not cause the amplitude to change more than ±2.5 dB.

15. **Modulator navigation tone control**

A control shall be provided to enable independent or simultaneous removal of the navigation tones from the RF carrier.

16. **Power and Modulation measurements**

For maintenance and test purpose, the means shall be provided to measure course and clearance carrier and side-band powers and carrier modulation percentage at the individual outputs to the antenna system’s signal distribution unit.

17. **Carrier signal at side-band output**

With the modulator adjusted for optimum conditions, for any combination of side-band amplitude control or side-band phaser control setting settings the carrier power appearing at the side-band output shall be 30 dB or more below the carrier power appearing at the carrier output.
18. **Distortion of demodulated navigation tones**

With the equipment adjust for optimum conditions, the signals appearing at the carrier output test jack and side-band output test jack shall be such as to produce a demodulated signal with distortion components which do not exceed the following:

**Carrier Test Jack**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distortion component referred to 90 or 150 Hz signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>60 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>180 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>240 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>270 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>300 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>450 Hz</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

With each frequency referenced to 90 Hz or 150 Hz, whichever is the larger signal.

**Side-band Test Jack**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distortion component referred to 60 or 240 Hz signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>150 Hz</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

With each frequency referenced to 60 Hz or 240 Hz, whichever is the larger signal.

19. **Identification keyer**

The transmitter shall include solid-state electronic keying facilities that shall modulate the carrier with a 1020 Hz tone without interruption of carrier. The keyer shall provide character timing as follows:

- Dot length : 0.125 second
- Dash length : 0.375 second
- Length of space between dots and dashes in a continuous series and within a code character : 0.125 second
- Length of space between characters : 0.375 second

The keying rate shall remain within ±15 percent of the design center values under the service conditions of temperature and humidity.
a. DME Keying Output

Provisions for synchronous keying of an associated DME facility shall be provided. When DME identification is desired, every fourth cycle of localizer transmitter identification keying shall be omitted and presented instead in the form of continuity keying of the DME output terminals. Thus the DME will be keyed with one cycle of Morse Code identification approximately every 30 seconds, followed by three (3) localizer keying cycles.

20. Automatic Change Over Unit

The automatic changeover unit shall cause the main transmitter to cease radiation when a station fault is detected and cause the standby transmitter to radiate.

B LOCALIZER ANTENNA ARRAY

The localizer antenna shall consist of a highly directional localizer antenna array. The array shall be wide aperture type using at least 14 antenna elements (LPDA), and operate through the range of 108 to 111.975 MHz without adjustments. The array shall operate as a two-frequency system and shall have its own integral monitor system, antenna array cable quality monitor(s), etc. Alternative localizer antenna array configurations may be proposed with supporting documentation that proves it can deliver the required performance.

The antenna system shall include interconnecting RF cables, obstruction lights and AC power cables. The interconnecting RF cables shall be low loss and phase stabilized cable with weather changes.

1. Radiation pattern characteristics

The Contractor shall provide a figure showing the critical and sensitive aerodrome areas required for his products. Radiation patterns of the Course Carrier (CSE CSB), Course Side-band (CSB SBO) and Course-to Clearance Carrier relationships shall also be provided. A diagram of the localizer antenna array including aperture size and other required shall also be provided. The Contractor shall present the characteristics of the proposed RF cable that is low loss and phased-stabilized with respect to weather changes.

2. Obstruction lights

Double obstruction lights in accordance with the criteria as specified by CAAP regulations shall be provided for mounting on both ends of the antenna array.
3. **RF distribution unit**

The array shall be furnished with the appropriate strip-line or micro-strip RF distribution units to provide the proper current excitation to generate the specified array patterns. The design characteristic impedance of the “carrier” input ports and the “side-band only” input ports shall be 50 ohms. The input voltage standing wave ratio (VSWR) at each of the inputs shall not exceed 1.2 over the frequency band service conditions of temperature and humidity. A weather proof box designed to be mounted above ground and equipped with hinged covers and hasp shall be provided to house all the RF distribution circuits. A terminal block shall be provided inside the box for connecting AC power to the obstruction lights. In addition, two weatherproof, three wire exterior, ground fault type convenience receptacles shall be mounted with incandescent light socket for a lamp of up to 100 watt rating. The socket shall be controlled by an on/off switch mounted inside the box.

4. **Horizontal and Vertical RF patterns**

The Contractor shall specify the RF vertical and horizontal pattern with descriptions providing the characteristics and drawings.

5. **Integral Monitoring**

The Contractor shall specify the characteristics of the integral monitor contained in the antenna array.

6. **Radomes**

The Contractor shall describe, in detail, the characteristics of the radomes used for antenna elements.

7. **Mechanical Design and Frangibility**

The antenna element, supporting structure, radome (if provided), cable raceways and distribution unit housing(s) shall be as light in weight as possible, consistent with good engineering design, to allow the array to collapse under impact from the wheels of an aircraft with minimum damage to aircraft. This value of impact energy is 4,000 inch pounds and shall only be considered on a line parallel with the runway centerline.

C **LOCALIZER MONITOR**

The localizer subsystem shall be provided with a high integrity. The localizer subsystem shall have dual, parallel monitors for both course and clearance signals such that each radiated course and clearance radiated parameter is examined by two identical monitor channels. Whenever two monitors detect an alarm status, the equipment transfer to shutdown shall automatically be initiated. For the full dual localizer, the total period of out-of-tolerance radiation of the main and standby
equipment, including the period of zero radiation during equipment transfer action, shall not exceed two (2) second.

The monitors shall have adjustable sensitivity controls for each of the parameters being monitored. It is required that the alarm sensitivity of all monitored parameters be capable of verification without changing the localizer radiation characteristics. The monitors shall also have an override switch that disables monitor action during adjustments and maintenance. Activation of the override switch shall energize the monitor alarm by-pass light.

1. **Localizer Monitor Stabilization**

   All channels shall be stabilized within 0.5 seconds after initial application of radiated signals.

2. **Fault conditions**

   The monitor shall detect a fault and initiate appropriate action as described in paragraph 4 below if any of the following occur:
   
   a. A shift of the course position exceeding \( \pm 5 \mu A \) of the nominal course position.
   
   b. A change in displacement sensitivity (course width) exceeding 10 percent of nominal.
   
   c. A radiated DDM of less than 0.155 between \( \pm 10 \) degrees to \( \pm 35 \) degrees.
   
   d. A reduction of radiated localizer RP power of 1 dB from nominal in either the course or clearance signal.
   
   e. A change of the 90 and 150 Hz modulation percentages outside the 19 to 21 percent limits.
   
   f. Identification tone continuously present for more than 17 seconds.
   
   g. Identification tone absent for more than 17 seconds.
   
   h. Reduction of identification modulation percentage. (Threshold adjustable over range of 2.5 to 12 percent modulation).
   
   i. An open or shorted connector on either end of any antenna feed-line.
   
   j. An open or shorted connector on either end of any integral monitor feed-line shall cause an alarm.
   
   k. A change in the frequency separation of the course and clearance transmitters beyond the limits of 5 kHZ and 14kHZ.

3. **Co-located Electronic Equipment**

   For DME electronic equipment that is co-located with the Glide Slope subsystem, the capability shall be provided to display the equipment’s status. The information shall be utilized to send equipment status (NORMAL and ALARM) to Remote Control Status Unit (RCSU) with the Glide Slope monitor data.
4. **Monitor Action**

If a fault is sensed by both monitors and persists for preset period of time (the delay shall have a minimum range of 0.5 to 10 seconds) or longer, the monitor shall initiate the following actions:

a. Cause radiation of the localizer transmitter to cease.

b. Cause transfer to the standby transmitters and activate the standby transmitters. If the fault persists for the balance of the preset period of time following transfer, the station shall shut down and prevent restoration for at least 20 seconds.

c. Following transfer or shutdown, initiate a local visual alarm and transmit the alarm indications to the RCSU.

5. **Signal Monitor Fault**

If only one monitor senses a fault and it persists beyond the preset period of time (CAT-1: 10 seconds), an indication of the signal monitor alarm status shall be transmitted to the RCSU.

6. **Localizer Monitor Fail-Safe**

The localizer monitor shall be fail-safe such that failure of any part of the monitor shall either result directly in an alarm condition, or shall not alter any alarm threshold level such as to allow an out-of-tolerance condition to occur. This fail-safe requirements shall be verified at Site Acceptance Test.

**D EQUIPMENT SHELTER**

1. All of the localizer subsystem electronics, air conditioning and ventilation fan shall be housed in a walk-in equipment shelter. The Contractor shall suggest the possible dual configurations for the air conditioning system to be installed in the equipment shelter.

2. The wake-in shelters shall provide areas with positioning the table for maintenance personnel along with required support equipment to perform all routine preventive and corrective maintenance task of the localizer electronic assemblies.

3. The shelter material shall be suitable for the intended application and treated for fire retardation and weather resistance.

4. The shelter shall contain lighting for nighttime maintenance by the technician, including a battery backed emergency light in the event of facility power light power is lost. The battery pack for emergency light shall be separated from equipment battery. The back up battery packs for equipment and emergency light shall be installed outdoors within all-weather proof enclosures.
E  LOCALIZER FAR FIELD MONITOR SUBSYSTEM

1. LOC FFM General Requirements
   a. Owners System Concept
      The localizer FFM subsystems (for runway 09 and 27) shall be suitable for CAT I ILS operations and shall consist of the following:
      1) The Contractor shall build a support structure for localizer FFM on the threshold at the runway 27 or that can compensate for salty atmosphere. The antennas that provide adequate gain for receipt of the localizer signal shall be mounted on an adequate support structure so as to provide satisfactory performance when mounted at heights from 1.83m (6 feet) to 7.6m (25 feet) above ground. The height shall be reviewed and approved by the Owner before installing.
      2) Dual (main, standby) FFM receivers and dual (main and standby) monitor units shall be installed in the threshold at the runway 27.
   b. Proposal Requirements
      An FFM configuration, functions, parameters to be monitored, and circuitry connected with the localizer monitor to meet CAT I requirements in this technical proposal must be presented.

2. FFM Receiver Performance
   The FFM subsystem shall contain VHF receivers designed to meet the following requirements over the environmental service:
   a. Frequency range: 108 to 111.975 MHz
   b. Sensitivity: 5 micro-volts for 10dB (S+N)/N, 20 percent modulation, 90 Hz.
   c. IF image rejection: 90 dB minimum.
   d. Frequency stability: ±0.002 percent.
   e. Localizer channel selection by a plug-in crystal or frequency synthesizer.
   f. Selectivity:
      15 kHz minimum at – 6 dB
      35 kHz minimum at – 60 dB
      60 kHz minimum at – 90 dB
   g. Input impedance: 50 ohms ±10 ohms
   h. Audio frequency response: for 20 percent modulation at 90 Hz and 150 Hz the audio output amplitudes shall be within ±0.1 dB of each other.
i. Audio output level: for a 20 micro-volt input signal 20 percent modulated at 90 Hz, the audio output level shall be adjustable from a to at least 125 percent of the minimum required for the monitor input.

j. Output: The output shall vary no more than 3 dB as the input is varied from AGC threshold to 10 millivolts.

k. Detectors linearity: The output shall vary linearly from 15 to 40 percent modulation. The DC output shall not vary more than 1 dB as the modulation is varied over the specified range.

l. Audio distortion: The audio distortion at 90 Hz and 150 Hz shall be no more than 5 percent over an RF input range of 50 micro-volts to 10 millivolts at 30 percent modulation.

m. Transient inputs: Filtering shall be provided to preclude short-term DDM changes of 1 Hz or faster to be output to the FFM monitor.

3. FFM and Control Panel

a. Monitor channels

Two identical monitor channels shall be provided at the FFM location to evaluate localizer course alignment and RF signal level. The monitors shall provide appropriate outputs (data and aural alarm) to the localizer local control status unit (LCSU), RCSU and control tower to indicate when the course alignment or RF levels deviate more than the CAT I requirements. The out of tolerance limits shall be adjustable from 0.0 ±0.15 DDM and 0 to –6 dB minimum.

b. Status Monitoring

1) A shift of the course position corresponding to 3.0 percent of the nominal course width when configured for CAT I operation.

2) A total loss of the radiated RF signal.

c. Status Monitoring

The control and status display function shall provide the following:

1) Monitor bypass switch to preclude monitor action. Activation of the bypass switch shall energize the monitor alarm bypass light.

2) DDM and RF signal strength information to the localizer local control status unit (LCSU), RCSU and control tower.

d. Time Delay Reset

The monitors, or Local Control Status Unit, shall reset the applicable localized FFM time delay timers each time the calculated DDM satisfies the following CAT I in-tolerance pre-condition: less than or equal to the CAT I course misalignment tolerance (tolerance shall be adjustable from 0 to 0.01 DDM)
e. **Monitor Fail-safe**

The FFM shall be fail-safe such that failure of any parts of the monitor shall either result directly in an alarm condition, or shall not any alarm threshold level.

4. **FFM Cabinet and Battery Requirements**

a. **FFM equipment cabinet**

The FFM cabinet shall be located FFM mounting rack.

b. **FFM battery**

The FFM battery pack shall be installed with a charger of sufficient capacity shall be provided. The battery shall be housed in an enclosure outside.

### 2.3 DME SUBSYSTEM

#### A. GENERAL REQUIREMENT

1. **Owner’s Subsystem Concept**

A Uni-directional Distance Measuring Equipment shall be used in place of middle and outer marker for ILS system. The DME subsystem shall be solid state equipment and consist of the following, as a minimum. It shall be co-located with Glide Slope.

a. Dual (main, standby) DME transponders – The associated modulation/demodulation, encoding, control and changeover equipment shall be included.

b. DME antenna array – The associated cabling, monitor pickup probe (or loop), and antenna support structure shall be included.

c. DME monitor and test group – This group shall consist of dual (main, standby) parallel monitors and special test equipment alignment.

d. Other ancillary items to be installed at the Glide Slope shelter.

e. Standby battery power supply with appropriate housing.

2. **Proposal Requirements**

The configuration or functions of DME which will be installed in place of the middle and outer marker must be presented in the technical proposal.

#### B. FUNCTIONAL AND OPERATIONAL REQUIREMENTS

The DME shall meet the requirements specified in DME portions of the DVOR/DME System Requirements Specification (Paragraph 2.3 and 2.4) with the following exceptions:
1. **Operational Coverage**

The UHF subsystem shall provide distance information to a suitably equipped aircraft engaged in ILS approach to land at the Laguindingan airport. The DME system shall provide accurate distance information to within 0.37 km (0.2 NM) up to the limit of its coverage. The coverage shall be wider than the associated localizer coverage.

2. **Operational Radio Frequency**

The DME subsystem shall be frequency paired with the associated VHF localizer in accordance with ICAO Annex 10, in the band 960 – 1215 MHz.

3. **Station Location and Antenna Height**

It is recommended to install the DME antenna near the associated Glide Slope Equipment Shelter for good performance. The height of DME antenna shall be such that it shall not penetrate the 50: 1 approach slope imaging surface of the appropriate ILS runway. The Contractor shall specify the functions, characteristics and the location of the antenna.

### 2.4 UHF GLIDE SLOPE SUBSYSTEM

**A. PERFORMANCE REQUIREMENTS**

The UHF glide slope subsystem shall be provide guidance in the vertical plane to aircraft engaging in approaches to and landing at airfield. The radiation from the UHF glide slope antenna group shall produce a composite field pattern that is amplitude modulated by 90 Hz and 150 Hz tone. The glide slope shall be capable of an adjustment to produce glide path angle between two and four degrees. The pattern shall be arranged to provide a straight line descent path in the vertical plane containing the runway centerline, with the 150 Hz tone predominating below the path and the 90 Hz tone predominating above the path, to at least an angle equal to 1.75 degree of the glide angle.

1. **Radio Frequency**

The glide slope transmitters shall be capable of operation in 0.150 MHz increments across the band of 328.6 to 335.4 MHz. The frequency tolerance shall not exceed ±0.002 percent over the service conditions. For Laguindingan Airport, the capture effect glide slope configuration which employs two carriers shall be provided, and the frequencies of the RF carriers shall be individually adjustable. The frequency separation between the carriers shall not be less than 4 kHz nor more than 32 kHz.
2. **Coverage**

With the course and clearance transmitter power output reduced to the monitor RF level alarm, the glide slope shall provide signals sufficient to allow satisfactory operation of a typical aircraft glide slope of the runway centerline extended to a distance of at least 10 nautical miles up to 1.75 of the glide slope angle and down to 0.45 of the glide slope or the angle corresponding to 0.22 DDM, whichever is lower.

3. **Polarization**

The emission from the glide slope antenna array shall be horizontally polarized.

4. **Carrier Modulation**

The nominal depth of modulation of the RF carrier due to each of the 90 Hz and 150 Hz tones shall be 40 percent and shall be maintained within the limits of 39 and 41 percent.

5. **Displacement Sensitivity**

The angular displacement sensitivity shall be symmetrical. The nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at an angular displacement of 0.35 degrees above and below the glide path. This value corresponds to a deflection of ±75 microamperes. The DDM below the ILS glide path shall increase smoothly for decreasing angles until a value of 0.22 DDM is reached. This corresponds to a “fly up” deviation of 190 microamperes. This value shall be achieved at and angle of not less than 0.30 of the glide slope above the horizontal. The glide path width and angle shall be so adjusted that an aircraft flying in such a way as to just clear all obstructions between the threshold obtains a signal of no less than 180 microamperes (0.21 DDM) “fly up”. With the displacement sensitivity widened or narrowed to the alarm point, no less than 150 microamperes (0.175 DDM) shall be obtained. The angular displacement sensitivity shall be adjusted and maintained within ±15 percent for CAT I of the nominal value selected. And, the DDM balance shall be met the CAT-1 requirements as specified in Figure C-11 of Attachment C to Part 1, ICAO Annex 10 – “Aeronautical Telecommunications”.

6. **Continuity of Service of the Glide Slope Subsystem**

The continuity of service of the glide slope subsystem shall be equal to or greater than 1-2x10-6 in any period of 30 seconds.

7. **Integrity of the Glide Slope Subsystem**

The integrity of the signal from the glide slope subsystem shall be equal to or greater than 1-0.5 x10-9 in any one landing.
B. COMPOSITION OF UHF GLIDE SLOPE

1. Owner’s Subsystem Concept

The glide slope subsystem (runway 09 and 27) shall be dual frequency design for use in a “Capture Effect” configuration. A complete capture effect UHF glide slope shall consist of the following.

a. Dual (main and standby) course and clearance transmitters with associated modulation, control and automatic changeover equipment.

b. One complete glide slope antenna group consisting of a metal tower, three identical transmitting antennas and associated coaxial cabling. The antennas shall include power distribution networks, integral monitoring probes, and combining networks.

c. Dual glide slope monitor group.

d. Equipment shelter.

2. Deviations and Exceptions to the Above Requirements

If the proposed configuration differs from the above, in order to employ new technology, it shall be stated in the technical proposal in detail for identification and review by the Owner. The following items are primary areas of concern.

- Reliability and Maintainability
- Status monitoring and Self-diagnostics
- Convenience for flight inspection: The flight inspection will be conducted in accordance with Philippine Flight Inspection Procedures (FAA OA P 8200.1 and ICAO Doc. 8071). If there are any function or feature intended to promote the convenience of flight inspection. The Contractor should describe them in details in his technical proposal, in the same order as the Philippine Flight Inspection Procedures.

- Transmitter group
- Monitor group
- Antenna assembly group
- Back-up power supply group

2.5 CHARACTERISTICS FOR MAJOR COMPONENTS OF GLIDE SLOPE

A. TRANSMITTER

The transmitters shall include an RF function, a modulator function and remote monitoring sensors as required and shall meet the following requirements.
1. Course Transmitter
   
a. Transmitter Output Power
   
The course transmitter carrier output power shall be adjustable over the range of at least 40 percent to 100 percent of the rated transmitter output power. Adjustment over this range shall not change the modulation balance by more than 0.002 DDM, the course width by more than 2.0 percent or the modulation percentage by more than 0.5 percent.

b. Transmitter Stability
   
When adjusted under normal test conditions for optimum transmitter conditions, changes in the following parameters over the service condition shall not exceed.

1) Carrier power at carrier output : ± 10 percent
2) Side-band ratio : ±0.5 dB
3) Carrier modulation : ± 1 percent (each tone)
4) Carrier modulation balance : ± 0.015 DDM
5) Side-band balance : ± 0.5 dB
6) RF phase between carrier and side-band outputs : ±10 degrees
7) Navigational tone frequency : ± 1.0 percent
8) Transmitter frequency : ± 0.002 percent

c. Stabilization Time
   
After initial adjustment under normal test conditions, the values of the parameters shall be gained within 0.5 seconds.

d. Control Functions
   
A control or switch shall be provided to turn the transmitter output radiation on and off. In addition, it shall be possible to select either local or remote control.

e. Crystals
   
Crystals shall be furnished to control course and clearance transmitter output frequencies assigned by the Owner. In lieu of crystals, transmitter frequency may be controlled by a crystal-referenced synthesizer adjustable over the full frequency range of 328 to 336 MHz in steps of 0.15 MHz.

The Contractor shall specify the option he selects, describe the characteristics and functions, and provide the schematic drawings.

f. Crystal Oven
   
A crystal oven shall not be used.
g. **Resonance Points**

There shall be no indication of more than one resonance point over the complete range of travel of adjustment for all controls normally used in tuning or adjusting the transmitter to meet equipment specification requirements.

h. **Indicator Lights**

Indicator lights shall be provided to indicate the application of power, local and remote control function activation.

i. **Modulator Design**

The modulator design shall provide an output containing the RF carrier modulated by the navigation tones, and an output containing only the separate side-band frequencies of the navigation tones. The modulator shall be of electronic and solid state design.

j. **Modulation Tones**

The modulating tones shall be 90 Hz and 150 Hz within ±1.0 percent. The total harmonic content of the 90 Hz tone shall not exceed 10 percent. The second harmonic of the 90 Hz tone shall not exceed 5 percent.

The depth of amplitude modulation of the radio frequency carrier at the power supply frequency or harmonics at other noise frequencies shall not exceed 1.0 percent.

k. **Audio Phase of Modulation Tones**

The modulation of course and clearance transmitter shall be phase-locked so that within the ILS half glide path sector, the modulated 90 and 150 Hz wave forms pass through zero in the same direction within 10 degrees of phase relative to the 150 Hz component, every half cycle of the combined 90 Hz and 150 Hz wave forms.

In addition, the 90 Hz modulating tone of one carrier shall be phase-locked to the 90 Hz modulating tone of the other carrier so that the demodulated wave forms pass through zero in the same direction within 10 degrees of phase relative to 90 Hz.

Similarly, the 150 tones of the two carriers shall be phase-locked so that the demodulated wave forms pass through zero in the same direction within 10 degrees of phase relative to 150 Hz.

l. **Carrier modulation**

Modulation of the carrier output signals over a minimum range of 36 to 44 percent of each navigational tone shall be accomplished by the use of a control adjustable, which shall not produce a change of more than ±5 degrees in RF phase between carrier and side-band outputs.
The Contractor shall specify the carrier modulation procedures and intervals for his system in his technical proposal.

m. **Side-band Amplitude Control**

A side-band amplitude control shall be provided to enable adjustment of the glide path full sector width. Adjustment of his control over its full range shall not cause the carrier to side-band phase to change more than ±5 degrees.

The Contractor shall specify the side-band amplitude adjustment procedures and internals for his system in his technical proposal.

n. **RF Phaser Control**

A phasing control shall be provided for shifting the RF phase of the signals appearing at the side-band output range of at least ±30 degrees from normal. With the complete facility radiating and properly phased the phaser control shall be set at midrange ±20 percent. Adjustment of this control over its full range shall not cause the amplitude to change more than ±.25 dB.

o. **Modulator Navigation Tone Control**

A control shall be provided to enable independent removal of the navigation tones from the RF carrier.

p. **Power and Modulation Measurements**

For maintenance and test purposes, the means shall be provided to measure course and clearance carrier and side-band powers and carrier modulation percentage at the output to each glide slope antenna.

q. **Carrier Signal at Side-band Output**

With the modulator adjusted for optimum condition, for any combination of side-band amplitude control or side-band phaser control settings, the carrier power appearing at the side-band output shall be 30 dB or more below the carrier power.

r. **Distortion of Demodulation Navigation Tones**

With the equipment adjusted for optimum conditions, the signals appearing at the carrier output test jack and the side-band output test jack shall be such as to produce a demodulated signal with distortion components which do not exceed the following.
### Carrier Test Jack

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distortion component referred to 90 or 150 Hz signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>60 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>180 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>240 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>270 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>300 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>450 Hz</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

With each frequency referenced to 90 Hz or 150 Hz, whichever is the larger signal.

### Side-band Test Jack

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distortion component referred to 90 or 240 Hz signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 Hz</td>
<td>5 percent</td>
</tr>
<tr>
<td>150 Hz</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

With each frequency referenced to 60 Hz or 240 Hz, whichever is the larger signal.

2. Clearance Transmitter

a. Clearance Transmitter Output Power

The transmitted carrier output power shall be adjustable over the range of at least 40 to 100 percent of the rated transmitter output power. The power output the transmitter shall be such that when operating with the specified antenna array and with the power reduced to the alarm point, all coverage requirements for glide path signal shall be met.

b. Modulation

A control shall be provided with permit adjustment of modulation to all values between 50 and 90 percent. The 150 Hz clearance transmitter modulation will be phase locked with the 150 Hz modulation from the course transmitter.

c. Transmitter Control

The clearance transmitter will be controlled by application and removal of primary power from the course glide slope transmitter or by the application of control signals from the local control unit. Additionally, a switch or control independent from the course transmitter while not interfering with monitoring of the course signals.
d. **Frequency Separation**

The course and clearance transmitter shall be designed to maintain a preset frequency separation of 4 - 32 kHz ± 0.5 kHz over service conditions.

e. **Stability and Stabilization Time**

The stability of signal characteristics and stabilization shall be identical to the course transmitter.

**B. CAPTURE EFFECT AMPLITUDE AND PHASE CONTROL UNIT**

The capture effect amplitude and phase control unit shall be designed to combine the separate carrier, side-band and clearance signals from the course and clearance transmitters in the appropriate amplitude and phase relationship for delivery to three transmitting antennas. Carrier signals will be radiated from the lower and middle antennas. Side-band signals will be radiated from all three antennas. Clearance signals will be radiated from all three antennas. Clearance signals will be radiated from the upper and lower antennas.

1. **Capture Effect Phase**

Phasers shall be provided in each of the antenna outputs. At the Contractor’s option these phasers may be either an integral part of the Amplitude and Phase Control Unit (APCU) or external to the APCU assembly.

The Contractor shall specify the option he selects and describe the characteristics and technique employed for his systems.

2. **Capture Effect Amplitude Control**

Continuously adjustable controls shall be provided to divide the power as required to:

a. Establish the proper ratio of the carrier power delivered to the lower and middle antenna outputs.

b. Establish proper ratio of side-band power delivered to the upper and lower antenna outputs.

c. Establish the proper ratio of the side-band power delivered to the middle antenna output with respect to the upper and lower antenna outputs.

Adjustment of each power divider throughout its range shall not change the RF phase between the antenna outputs by more than ±2.0 degrees.

In lieu of continuously adjustable controls, a broadband, fixed ratio power divider similar in function to that feeding the localizer antenna system may be provided. This power divider shall provide the required power ratio for each antenna over the full range of
operating conditions and environmental service conditions. The RF phase between the antenna outputs of the power divider shall not deviate by more than ±2.0 degrees over the full operating frequency range of environmental service conditions.

The Contractor shall specify which divider of the two, variable and fixed ratio power dividers, will be selected and describe the selected functions and characteristics in detail for Owner review.

3. **Capture Effect Isolation and Stability**

The Contractor shall describe the following subparagraphs in the technical proposal, for the amplitude and phase control unit of the proposed system.

   a. Capture effect carrier isolation and stability
   b. Capture effect side-band isolation and stability
   c. Capture effect clearance line sections

4. **Variable Attenuator Assembly**

To perform antenna signal attenuation testing during flight inspection, a variable attenuator-constant phase assembly shall be provided. The attenuator assembly shall preclude inter-antenna phasing assembly which shall be designed to be installed in the antenna feed-line. The attenuator assembly shall preclude inter-antenna phasing changes when the assembly is inserted. The attenuation shall be adjustable from 0.2 dB to 2.0 dB in 0.2 dB steps. The phase shall remain stable (±10 degrees) when the attenuation is changed. The total insertion loss of the assembly shall not exceed 0.2 dB when the attenuator is set to 0.0dB.

5. **Automatic Changeover Unit**

The automatic changeover unit shall cause the main transmitters to cease radiation and cause the standby transmitters to radiate. The changeover unit shall configure the antenna system to the radiating transmitters.

C. **GLIDE SLOPE ANTENNA ARRAY**

The capture effect glide slope antenna array shall consist of three identical antennas. All antennas shall be interchangeable. Each antenna may consist of single or multiple horizontally polarized elements combined with a reflector to meet the required gain, vertical and horizontal pattern requirements. Antenna elements reflectors shall be of the same metal type to prevent electrolytic action where they join together. Antenna heaters and radomes may be utilized to satisfy the total requirements for operation under the environmental conditions (severe hot, heavy rain, strong wind, salty atmosphere, etc., shall be considered).
The Contractor shall explain his capture effect glide slope antenna array in his technical proposal. The antenna configuration, major characteristics, horizontal and vertical pattern, distribution network, integral monitoring system, etc. employed for his system shall be included. The Contractor shall also specify weather antenna heaters are used or not.

1. **Polarization**

The radiated signal of the antenna shall be horizontally polarized. The vertical component shall be at least 25 dB below the horizontal components as measured in front of the antenna and within ±25 degrees in azimuth of a vertical plane perpendicular to the antenna and passing through the center of the antenna.

2. **Gain**

The gain of the antenna shall be such that the free space radiation from the antenna at zero degrees in azimuth shall not be less than 10 dB above that of a loss less isotropic radiator.

3. **Characteristic Impedance**

The design center impedance of the components and assemblies shall be 50 ohms.

4. **Front-to-back Ratio**

The front-to-back ratio of radiated signal shall be not less than 16dB.

5. **VSWR**

The input VSWR of the antenna shall not exceed 1.2 under normal test conditions with the antenna fed from a 50ohm line. Over the full range of service conditions, the VSWR shall not exceed 1.3.

6. **Coaxial Cable**

RF cable shall be low-loss, phase-stable with abrupt weather changes. The Contractor shall provide the phase variance rate for weather changes, providing the related data source.

7. **External RF Network**

An external RF network shall be provided to combine the pickup network outputs of the upper, middle and lower arrays. The external RF network shall be designed for mounting in the glide slope shelter.

8. **Response to Open and Short Circuits in Arrays**

The pickup devices and associated RF networks shall be designed to detect out-of-tolerance changes in the radiated signal of any antenna array due to short or open circuits in the distribution network or in the individual antenna elements or pickup probes from individual antenna elements.
9. **Antenna Radomes**

Antenna radomes shall be fabricated of Type 3 glass fiber base plastic material or rigid ABS (Acrylonitrile – Butadiene – Styrene) material, or other equivalent material.

10. **Antenna Mounting**

The antennas and associated distribution units (when utilized) shall include mounting provisions to enable vertical mounting on the tower to produce glide angles between 2 and 4 degrees. Means shall also be provided to laterally offset the antennas, in 2.54 cm (1 inch) increments, at least ±45.7 cm (18 inches) from the centered position on the tower.

11. **Antenna Towers**

The glide slope antennas shall be mounted on a metal triangular-shaped sectionalized tower. The forward facing side (toward the approach end of the runway) of the tower shall be perpendicular to the runway centerline. Each tower shall include a ladder (with uniformly spaced steps a minimum of 40.6 cm (16 inches) wide and a maximum of 30.5 cm (12 inches) apart, obstruction lights, safety climbing-equipment, and anchor and other related installation hardware.

12. **Obstruction Lights**

A double obstruction light in accordance with the criteria as specified by CAAP Regulations shall be provided at the top of the antenna tower.

13. **Safety Climbing Equipment**

One set of safety climbing-equipment shall be provided with each glide slope antenna tower. The Contractor shall describe in his technical proposal the type and quantity of the safety climbing equipment to be provided with antenna hardware. The followings are provided as a reference:

a. Rigid type carrier.
b. Lanyard.
c. Slides or Safety sleeves and Safety belts.

D. **GLIDE SLOPE MONITOR**

The glide slope subsystem shall be provided with a high integrity monitor system that meets the requirements of the localizer monitor specified in paragraph 2.2C, except that the radiated signal deviation conditions shall be as specified in paragraph 2.5D2.

To insure the integrity of the glide slope signals, monitor signals shall be provided by pickup devices located at each antenna array. By suitable signal combining, the integral monitoring system shall provide composite signals for the monitoring of path position, path width, power level, carrier percent modulation and below path clearance.
The Contractor shall describe the configuration, performances and characteristics of his glide slope monitor in his technical proposal.

1. **Glide Slope Monitor Stabilization**

   All monitor channels shall be stabilized within 0.5 seconds after initial application of radiated signals.

2. **Fault Conditions**

   The monitor shall detect a fault and initiate appropriate action (Refer to paragraph 2.5D3) if any of the following occur:
   
   a. A shift of the mean glide path by more than ±0.12 degrees.
   b. A change in path half sector width exceeding ±0.17 degrees of nominal.
   c. A reduction of radiated power of the course transmitter of 1.0 dB from nominal.
   d. A change of the 90 and 150 Hz modulation percentages of the course transmitter outside the 39 to 41 percent limits.
   e. A deterioration of the glide slope system that would result in an out-of-tolerance reduction of the below path clearances.
   f. A reduction of the radiated power from the clearance transmitter of 1.25 dB from nominal.
   g. A reduction of the ±50 Hz modulation of the clearance transmitter by 15 percent.
   h. An out-of-tolerance separation between reference (course) and clearance transmitter frequencies.

3. **Monitor Action**

   If a fault is sensed by both monitors and persists for a preset period of time (adjustable range of 0.5 to 10 seconds) or more, the monitor shall initiate the following actions:
   
   a. Cause radiation of the glide slope transmitters to cease.
   b. Cause transfer to standby transmitters and activate the standby transmitters. If the fault persists for the balance of the preset period of time following the transfer, the station shall shut down and prevent restoration for a period of at least 20 seconds.
   c. Following transfer or shutdown, initiate a local visual and aural alarm and transmit the alarm indications to RCSU.

4. **Single Monitor Fault**

   If only one monitor senses a fault (another monitor senses as normal), and it persists beyond the preset period of time (CAT I: 2 seconds), an indication of the single monitor alarm status shall be transmitted to the RCSU.
5. **Glide Slope Monitor Fail-Safe**

The glide slope monitors shall be fail-safe such that failure of any parts of the monitors shall either result directly in an alarm condition, or shall not alter any alarm threshold level such as to allow an out-of-tolerance condition to occur. This fail-safe requirement shall be verified at site acceptance test.

E. **EQUIPMENT SHELTER**

The glide slope subsystem electronics shall be housed in a walk-in equipment shelter. The shelter shall meet requirements specified in paragraph 2.2D as much as applicable. The battery shall be housed outside the shelter.

2.6 **SYSTEM REMOTE MONITORING AND CONTROL SUBSYSTEM**

System monitoring and control subsystem shall consist of a remote status indication and control equipment (RICE, a remote maintenance monitoring (RMM) subsystem, and remote control and monitor lines.

The following are the requirements for the system’s configuration and functions. If the Contractor makes any deviation or exception to these requirements in order to employ new technology, or to combine the ILS and DVOR/DME RICEs into a unit, it shall be described in the technical proposal, in the same order as the following paragraphs and subparagraphs.

A. **REMOTE STATUS INDICATION AND CONTROL EQUIPMENT (RICE)**

1. **Remote Control Status Unit (RCSU)**

   The RCSU shall provide control and monitor of the CAT I ILS subsystems.

   a. **Functional Capabilities**

      The RCSU shall process the following functional capabilities:

      1) ON/OFF and RESET control of the localizer and glide slope (including co-located DME) subsystems. The RCSU shall also pass and FFM BYPASS control commands received from, and the localizer respectively.

      2) Visual indication of the status, including monitor bypass, of the localizer and glide slope (including co-located DME) subsystem.

         - **NORMAL/ON** status indicators shall be green.
         - **ALARM/OFF** status indicators shall be red.
         - **ABNOMAL** status indicators shall be amber.

      Aural alarms shall be initiated for changes in the operational and/or environmental status of each subsystem and any monitored co-located equipment.
3) The status data shall contain the following information:
   a) Current ILS subsystem, and co-located equipment, status and alarm information.
   b) The start of the FFM alarm timer (received from the localizer monitor/local control unit).
   c) Information to control the state of CAT I and OFF indicators.

4) Interpret localizer and glide slope subsystem status to determine the “category of operation” that the ILS can support. The category indicators that shall be supported by the RCSU are:
   • CAT - I (ON/OFF)
   • LOC ONLY (ON/OFF)

The loss of a transmitter at the LOC or GP shall result in the RCSU “MAIN” status indicators being extinguished and the “STANDBY” indicator being illuminated.

5) Provide ON and OFF status for the co-located equipment with ILS subsystems. When co-located equipment is operating normally, its status input from the ILS subsystem shall cause:
   a) An ON indicator to illuminate on that subsystem’s status panel and,

When the equipment is in alarm status, an OFF indicator shall be illuminated at the RCSU.

6) Implement subsystem status indicator changes and aural alarms within one (1) second of receipt of a message announcing a change in facility status for any subsystem.

7) FFM BYPASS capability that, when selected, will send control information to the FFM monitor circuit in less than or equal to 2 seconds. Implementation of the FFM BYPASS function shall cause illumination of BYPASS indicators on the RCSU.

8) The aural and silence volume control shall adjust the output amplitude continuously. The minimum amplitude shall be such that the alarm is discernible at a distance of 9.14m (30 feet) with no background noise.

9) Ability to test the operability of all RCSU indicators.

10) Visual and aural indications when AC power is lost.

11) Battery backup to ensure uninterrupted operation of the RCSU for the loss of prime power. The loss of prime power shall not affect the functionality of RSCU, or any ILS subsystem.

The RCSU shall be mounted in a standard relay rack. Panel height and the depth shall be suitable for the intended application.
B. REMOTE MAINTENANCE MONITOR

The RMM shall be configured to be able to monitor remotely, record and verify the operating status of ILS system as well as the sensing data from all of the environmental sensors. The Contractor shall describe an RMM subsystem that provide the following.

The appropriate photos, pictures or diagrams shall be included.

• Configuration and maintenance functions
• Functions to be monitored remotely (including environmental parameters)
• Functions to be controlled remotely
• Events to be date/time stamped, confirmed and stored
• Stored events, status and parameter changes are to be printable in various formats.

2.7 PORTABLE ILS/DVOR FIELD TEST SET

A. COMPOSITION

The portable ILS/DVOR Field Test Set (FTS) shall be designed and configured to analyze all of the ILS (Localizer, Glide Slope) and DVOR navigational signals properly. In addition to portable ILS/DVOR Field Test Set (FTS), additional equipment needed for CAT-I maintenance shall be provided.

B. PROPOSAL REQUIREMENTS

The Contractor shall describe the following, with drawings and photos, as required for the Field Test Set (FTS).

1. Configuration and Performances
2. Signal analysis per system (including the frequency selection method)
3. Data recording method
4. List and Brief description of additional equipment necessary for the maintenance of CAT-I ILS system

2.8 SYSTEM INSTRUCTION BOOKS, TEST EQUIPMENT AND SPARE PARTS

A. INSTRUCTION BOOKS

Five (5) copies of the instruction books needed for installation, check-out, alignment, calibration, operation and maintenance of ILS system equipment shall be furnished with the system.
B. TEST EQUIPMENT AND TOOLS

As a minimum, the test equipment and tools needed for installation, check-out, alignment, calibration, operation and maintenance of ILS system shall be furnished as follows:

1. All special to type tools
2. One oscilloscope and one multimeter shall be provided per equipment shelter (localizer, glide slope equipment shelter)
3. One RF generator, one audio generator, one frequency counter, one multimeter shall be provided as common use items.
4. The proposal shall include a list of basic standard and special test equipment. Additional specific test equipment other than the items stated in subparagraph 1, 2 and 3 above shall also be presented as an operational separate item with the cost proposal.

C. SPARE PARTS

1. PCBs and Modules
   For ILS/DME system, the Contractor shall provide a list of PCBs and modules installed per equipment and failure rate per each item, in the technical proposal. The PCBs and modules used during the first three (3) years operation shall be provided.

2. Consumables
   The consumables used during the first three (3) years operation shall be provided.

3. Supply after Acceptance
   The Contractor shall provide spare parts free of charge if there is any discrepancy in line with installed quantity in the system.

2.9 PREPARATION FOR DELIVERY

A. PRESERVATION AND PACKAGING
   Preservation and packaging of items shall be in accordance with best commercial practice.

B. PACKING
   Packing of items shall be in accordance with best commercial practice. No more than one of each item and associated hardware shall be packed in each shipping container.

C. MARKING
   Each packing and shipping container shall be durably and legibly marked with the following information:
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Name of item</td>
</tr>
<tr>
<td>2.</td>
<td>Serial number(s)</td>
</tr>
<tr>
<td>3.</td>
<td>Quantity</td>
</tr>
<tr>
<td>4.</td>
<td>Contractor number</td>
</tr>
<tr>
<td>5.</td>
<td>Gross weight of container</td>
</tr>
<tr>
<td>6.</td>
<td>Manufacturer’s name</td>
</tr>
</tbody>
</table>
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DIVISION 2 : DOPPLER VOR/DME

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PART 1 – DESCRIPTION

1.1 SCOPE

This specification sets forth the performance requirements and technical characteristics of a Doppler Omni-directional Range (DVOR)/Distance Measuring Equipment (DME) system.

The DVOR/DME shall support terminal navigation and non-precision VOR approaches as specified in ICAO Annex 10.

The VOR shall be a Doppler VOR (DVOR).

1.2 REFERENCE

- THE RULES AND REGULATION OF THE REPUBLIC OF PHILIPPINES

- ICAO DOCUMENTS
  
  Annex 10 Volume 1  
  ICAO Doc. 8071 Volume 1
  
  Aeronautical Telecommunications  
  Flight Testing Procedures

- FAA DOCUMENTS
  
  FAA-STD-003  
  FAA OAP 8200.1
  
  Paint Systems for Structures  
  United States Standard Flight Inspection manual

- RTCA Documents
  
  DO-178B  
  DO-216
  
  Software Consideration in Airborne Systems and Equipment Certification  
  General specifications for Ground Based Electronics Equipment
# 1.3 ABBREVIATIONS

The abbreviation/acronyms are used in this specification, they have the following meanings.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternate Current</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude Modulation</td>
</tr>
<tr>
<td>APCU</td>
<td>Amplitude &amp; Phase Control Unit</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATCT</td>
<td>Air Traffic Control Tower</td>
</tr>
<tr>
<td>CAAP</td>
<td>Civil Aviation Authority of the Philippines</td>
</tr>
<tr>
<td>CAT</td>
<td>Category</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DDM</td>
<td>Difference in Depth of Modulation</td>
</tr>
<tr>
<td>DME</td>
<td>Distance Measuring Equipment</td>
</tr>
<tr>
<td>DVOR</td>
<td>Doppler VHF Omni-directional Range</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>ERP</td>
<td>Effective Radiated Power</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration, USA</td>
</tr>
<tr>
<td>FFM</td>
<td>Far Field Monitor</td>
</tr>
<tr>
<td>FM</td>
<td>Frequency Modulation</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument Flight Rules</td>
</tr>
<tr>
<td>ILS</td>
<td>Instrument Landing System</td>
</tr>
<tr>
<td>KHz</td>
<td>Kilo hertz</td>
</tr>
<tr>
<td>LRU</td>
<td>Line Replaceable Unit</td>
</tr>
<tr>
<td>MAC</td>
<td>Monitor and Control subsystem</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
</tbody>
</table>
PROPOSAL FOR PRODUCTS TO BE FURNISHED

The Owner intends to have a DVOR/DME system established at Laguindingan Airport. The DVOR/DME system shall consist of a DVOR subsystem, a DME subsystem, a System Monitoring and Control Equipment and other necessary subsystems. All the equipment shall be dual (main and standby) except for antennas.

The Contractor’s proposal shall include the description of the products that meet or exceed the performance requirements specified in this specification. The physical configuration of the proposed system may differ from the description in this specification but the performance requirements shall be met. If the suggested configuration contains deviations from and exceptions to the requirements in this specification, the Contractor shall indicate in this Technical Proposal and prove logically its compliance with functional requirements or improvements over the Owner’s requirements with supporting data.

The Proposal shall include a listing of all components including the quantity of each item for the DVOR/DME system to be established for Laguindingan Airport in accordance with reference to Paragraph 1.5 bellow. The Proposal shall include all special-to-type tools, standard tools, test manuals, spare parts and training plans required for the operation and site maintenance of the systems to be established.
The technical proposal shall be organized in the same order and numbered in the same way as this specification, and be accompanied with photos, drawings, etc. as appropriate and a duplicate of typical as-built technical manuals as necessary so that the Owner can fully understand the contents of the proposal. When the proposed products have different characteristics (improvements) from what this specification requires, the Contractor shall highlight the corresponding part of the proposed equipment by underlined and bold-type letters to aid Owner's Representative in identifying changes during the review.

If the Contractor fails to respond appropriately to this System Requirement Specification (SRS) such as failure to provided photos, diagram or description of the performance requirements, etc., so that it is very hard for the Owner’s representative to make a judgement, he will be deemed to have no intention to bid, and may be evaluated as non-responsive to the technical equipments.

1.5 ITEMS AND QUANTITIES TO BE FURNISHED BY THE CONTRACTOR

The contractor shall provide all the items necessary to establish and operate a DVOR/DME system. The table below is intended to provide references to the Contractor for developing his technical proposal.

<table>
<thead>
<tr>
<th>NO</th>
<th>Items</th>
<th>Qty</th>
<th>Refer to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DVOR subsystem</td>
<td>1 Lot</td>
<td>Para. 2.1B</td>
</tr>
<tr>
<td>2</td>
<td>DME subsystem</td>
<td>1 Lot</td>
<td>Para. 2.3</td>
</tr>
<tr>
<td>3</td>
<td>System Monitoring and Control and ancillary equipment</td>
<td>1 Lot</td>
<td>Para. 2.5</td>
</tr>
<tr>
<td>4</td>
<td>Operation and Maintenance Manual</td>
<td>8 Set</td>
<td>Para. 2.6A</td>
</tr>
<tr>
<td>5</td>
<td>Test Equipment and Tools</td>
<td>1 Lot</td>
<td>Para. 2.6B</td>
</tr>
<tr>
<td>6</td>
<td>Site Spare Parts</td>
<td>1 Lot</td>
<td>Para. 2.6C</td>
</tr>
</tbody>
</table>

1.6 GENERAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION

The requirements specified in following subparagraphs are extracted from RTCA DO-216 with some modifications to satisfy the needs of the Owner, and shall be applicable to the entire DVOR/DME system unless otherwise indicated.

For the items specified in RTCA DO-216, but not specified bellow, RTCA DO-216 be applied.

A. EQUIPMENT PHYSICAL DESIGN

The equipment shall be designed in such a manner as to facilitate the accomplishment of all testing, adjustments and maintenance operations.
1. **Equipment Cabinets**

   All the equipment shall be housed in an enclosed cabinet. The cabinets shall include appropriate provisions for ventilation and a meter indicating operating status and operating hours (both main and standby). Cabinet material shall be durable and non-corrodable. The thickness of the material and method of forming and reinforcing shall be such as to result in a rigid assembly capable of supporting all of the equipment while in a fully open condition without twisting or warping the cabinet. The cabinet shall be floor mounted.

2. **Front Panels**

   Front panels shall be of a uniform thickness with sufficient strength to support attached components and to withstand repeated openings without deformation. When blank panels are required to fill empty spaces in the equipment cabinet, they shall be of the same material and thickness as the equipment front panels.

3. **Equipment Unit Construction**

   Major assemblies or Line Replaceable Units (LRU) shall be designed to be completely removable from their enclosures without disassembly. Access shall be provided to modules or subassemblies from outside the basic equipment from the front or rear of the equipment or through the use of swing-out chassis, pull-out drawers with mounting slides or similar means. If slides are used, they shall be heavy duty, full suspension roller type drawer slides capable of supporting the weight of the equipment without bending, bowing or coming out of track. The slides shall be provided with latching stops to limit the travel of chassis to that sufficient for complete access to all components, and by intentional unlatching of the stops, to permit complete removal of the chassis from the cabinet. A photo of the cabinet and that of each unit must be submitted so that the Owner can evaluate the configuration or location of the proposed modules, cards and sub-assemblies.

**B. ADJUSTMENTS**

The DVOR/DME equipment shall be designed such that all transmitter, transponder, monitor and control adjustment essential for proper operation and maintenance and all indicators shall be accessible via the RMM unit an/or appropriate local display unit.

1. **Adjustment Display**

   A portable terminal connected to the RMM monitor shall be capable of displaying all control settings on a neatly formatted screen or screens. For purposes of making adjustments, parameters will be selectable by cursor,
menu, or by an alphanumeric code. For a system which requires operator input to make adjustments, on-screen help shall be provided. Any device or feature that facilitates the adjustments by providing diagrams an/or descriptions must be presented.

2. Adjustment Storage

Electronically entered control settings must be stored automatically or by operator’s input, into non-volatile memory storing for at least 90 days, either immediately upon entry and/or at the conclusion of an adjustment/maintenance operation.

C. INTERIOR EQUIPMENT FINISHES

The surface of all metal cabinet and all panels, shelves, drawers and enclosures of the DVOR/DME equipment cabinets shall receive one or more uniform spray coats of semi-gloss enamel after the prime coat. The color of the final coat will be selected by the Owner. The finish provided will be baked to a hard durable surface.

D. EXTERIOR EQUIPMENT FINISHES

The DVOR/DME antenna, counterpoise structure, FFM antenna support to be furnished by the contractor shall be painted in an obstruction marking configuration in accordance with the Owner’s choice. Paint quality and the finish shall be in accordance with FAA-STD-003, or equivalent industry standard, which shall be able to endure a safety environment.

E. ELECTROMAGNETIC INTERFERENCE CONTROL

Each subsystem shall be designed so that the mean power of spurious RF emission to the antenna transmission line shall be not less than 60 dB below the mean power of the fundamental. With each transmitter terminated into a dummy load or a properly terminated cable, the stray radiation on the frequency from the equipment under any operating condition shall not exceed 5.0 micro-watts effective radiated power (ERP).

The requirements of ICAO Annex 10 paragraph 3.3.8 regarding the immunity to interference for VOR receiving systems shall apply to VOR monitor receivers, and the Contractor shall highlight the corresponding part of the proposal by submission of the list or the test related in order for the Owner to find and review it easily.

F. TEST POINTS, CONNECTORS & FAULT DIAGNOSTICS

Each line replaceable unit (LRU) of the DVOR/DME equipment shall contain test points and connectors appropriately labeled and numbered to provide for the examination of essential voltages, signal amplitudes, wave forms and timing
characteristics and to provide for the connection of test equipment for troubleshooting, adjustment and maintenance operations. Units employing micro-processors shall be provided with a diagnostic routine (BITE) capable of locating the cause of any failure to at least the LRU.

The diagnostic routine shall be executed automatically upon application of power, and if unsuccessful, the results shall be transmitted to the site monitoring unit or the central monitoring point as a diagnostic alarm message. If a portable terminal is connected to the subsystem terminal interface, the alarm message shall be transmitted to the portable terminal. In addition, it shall be possible to initiate the diagnostic routine from the subsystem terminal interface, and the central point. Fault diagnostics item, characteristics and function must be provided.

G. **RESET SWITCH**

Each subsystem of the DVOR/DME that employs microprocessors shall have a front panel mounted, momentary contact switch labeled “RESET”. Activation of the reset switch shall cause all program variables and all software/firmware controlled hardware to be initialized to a predefined condition from which normal program execution can continue.

H. **TRANSMITTER RF POWER SAMPLING**

Means shall be provided to measure forward and reverse RF powers, with an accuracy of ±5%, for the DVOR/DME transmitter.

I. **TEST METER**

A meter or other indicator(s) shall be provided to allow convenient monitoring of functional parameters required for initial equipment tune-up, preventive and corrective maintenance.

J. **LOCAL STATUS INDICATORS**

Each subsystem shall be provided, as a minimum, with indicator lamps to indicate operational status as follow:

- Station normal (green)
- Monitor alarm (red)
- Monitor alarm by-pass (amber)
K. SPARE PARTS, TEST EQUIPMENT AND TOOLS

All spare parts, test equipment and tools required to operate and maintain the DVOR/DME equipment shall be provided in accordance with paragraph 2.6 of the SRS a minimum. In addition, a convenient means of mounting or storing the tools or cables shall also be provided.

L. VOLTAGE REGULATORS

Voltage regulation in the equipment shall be provided (if required) by means of voltage or current regulators, or both, in the DC output circuit of the power supplied.

M. TRANSIENT PROTECTION

The equipment shall be protected against damage or operational impairment due to induced transient currents on any ungrounded power lines, communication, control, signal or monitor line entering or leaving the subsystem or ancillary unit. Transient protection shall be provided in accordance with paragraph 3.1.2.7.1 of RTCA Specification Do-216.

In addition to the above, the Contractor may nominate other effective techniques for protection of the equipment from external transient.

N. ENVIRONMENTAL SERVICE CONDITIONS

1. For Equipment Installed in an Equipment Building:

The environmental service conditions required for equipment installed in equipment building shall be as follows:

a. Temperature : -50° to +70°
b. Relative humidity : to 100%

2. For Equipment Installed Outdoor

The environmental service conditions required for equipment enclosures installed outdoors shall be as follows:

a. Temperature : -10° to +55°
b. Relative humidity : to 95%
c. Wind speed : up to 161km per hour (100MPH)
d. Altitude : To 15,000 ft MSL  
   (4,500m)

e. Capability to endure a salty/smoggy atmosphere

3. **For Equipment Installed in Attended Facility**

   The environmental service conditions required for equipment installed in an attended equipment room or operation room shall be as follows:

   a. Temperature : +10° to +45°

   b. Relative humidity : 10% to 80%

O. **PRIMARY POWER**

   The Primary Power of the Laguindingan airport will be 220 V AC, 60Hz, three phase. The DVOR/DME system to be furnished shall be designed and fabricated to fit the primary power requirements mentioned above. All the utility outlets for all subsystems and test equipment will be supplied from 220V AC supply. All equipment shall be operated with DC power supply.

P. **STANDBY POWER**

   The DVOR/DME subsystems shall operate using a continuously charged DC battery power supply system which will support a continued, uninterrupted normal operation in the event of a main power failure. The Contractor shall state his strategy for operating uninterrupted power for all systems. The Proposal shall contain the minimum running time using the proposed battery power source when mains supply is removed, including the critical battery discharge point for each facility type, the time required for the self-restore capability to recharge flat batteries up to 100%, and where and how to install the battery packs.

   The remote monitoring and control unit, and remote status and interlock unit, if separately powered, shall include a standby battery. The battery shall include an automatic recharge circuit and the battery shall provide at least two hours of operation upon failure of a primary power.

   When primary power is restored the state of the battery shall in no way cause harm to or affect the operation of the respective subsystems.

Q. **LIGHTNING SURGE PROTECTION**

   The internal and external lightning surge protection system to be provided by the Contractor must meet the best industry standards. The Contractor shall also be
required to submit an analysis report on the coverage of the lightning surge protection system.

R. MAINTAINABILITY

1. System Configuration

The Contractor shall submit a summary statement with procedures and schematic drawings for routines to provide easy preventive maintenance, which will allow rapid and accurate trouble shooting, repair and economies for flight inspections.

2. Corrective Maintenance Requirements

The Contractor shall state the Mean Time to Repair (MTTR) for his system. The repair time specified shall include diagnostic time, disassembly and removal of the failed LRU(s), replacement and installation of the new LRU(s) including any adjustments data loading necessary to initialize the LRU(s) and all adjustment required to return the DVOR/DME to normal operation. The Contractor shall include the trouble shooting procedures of his proposed system in the Technical Proposal.

3. Preventive Maintenance Requirements

The mean preventive maintenance time (MPMT) of the maximum electronic equipment configuration for the DVOR/DME system shall not exceed ten (10) hours during 180 days. The MPMT includes all of the time required to complete the routine checks and inspections necessary to assure normal operation. Ninety-five percent of all routine procedures required for the DVOR/DME shall be accomplished in less than 15 minutes. No single group of periodic procedures shall require more than on hour. The Contractor shall provide the preventive maintenance procedures for his proposed system in the Technical Proposal.

S. RELIABILITY

The Contractor shall qualify, through demonstration and calculations, using a serial reliability model, the DVOR/DME system reliability figures and Mean Time Between Failures (MTBF) as specified below. Reliability predictions shall be in accordance with paragraph 3.2.3.4 of RTCA Specification DO-216 and be stated in the following format.
1. **DVOR** ; ≥ **hours**

2. **DME** ; ≥ **hours**

3. **Remote Status and Communication Equipment (RSCE)** ; ≥ **hours**

This model shall not include terminals, modems, telephone lines, or any other interface circuitry.

For reliability validation by the Owner, the Contractor shall provide an official test report with data conducted by FAA or equivalent international agencies.

**T. SOFTWARE**

Software for the DVOR/DME system shall be developed using the RTCA document DO-178B, “Software Considerations in Airborne Systems and Equipment Certification” or an equivalent commercial standard.

**1.7 OBSERVANCE OF THE CONTRACTOR**

This paragraph contains additional information on administrative and contractual terms and conditions as following.

(1) The contractor shall provide the qualified engineers or technicians during equipment, adjustment, calibration, test, fault isolation, repair, ground support of flight Test, and data collection.

(2) The contractor shall provide air transportation, lodging, local vehicle, international telephone fee, correspondence and subsistence requirements of the contractor's engineers or technicians.

(3) The contractor shall be responsible for the safety of personnel and shall be held responsible for accidents which may occur during the period of this project.

(4) The contractor shall have the full responsibility for the adjustment, testing, alignment, recovery or replacement of loss and damage to all equipment.

(5) The contractor shall consult the Owner in case of the contradiction or anything not mentioned in this specification.
A. ACCEPTANCE TEST

1. FACTORY ACCEPTANCE TEST (FAT)

The test shall be carried out at the Contractor’s factory and on his responsibility in the presence of the Owner’s representatives. These shall consist of visual inspections, operation tests, insulation resistance tests, withstand voltage test, earth test, ratio tests, etc. in accordance with the manufacture’s standards.

The Contractor shall bear the cost of transportation of the Owner’s representatives and Consultant’s Air Navigation Specialist from/to their hotel, from/to Philippines by regular fare including local transportation from the hotel to the factory site. The Contractor shall also bear the cost for the hotel accommodation and food as well as daily expenses covered by payment of US Dollars 300 per diem by the Contractor to each person. Expenses to be incurred for the two (2) Owner’s representatives and one (1) Consultant’s Air Navigation Specialist spending ten (10) days of stay (inclusive of travel time) shall be included in the proposal.

2. SITE ACCEPTANCE TEST (SAT)

(1) The SAT procedure is a series of tests to be carried out by the contractor and witnessed by the Owner. These tests shall be performed to verify the optimum performance of the entire system in accordance with the requirements outlined in the technical specifications of this document and shall include precise tests and evaluations of installation status, performance and operation status.

(2) If any part of the site acceptance test is declared unsatisfactory by the Owner, acceptance will not be possible. When the amount of work comes up to the standard in accordance with the installation procedures, acceptance will be accomplished.

3. DATA PREPARATION FOR ACCEPTANCE TEST

The contractor shall prepare items to be checked and tested for the SAT and shall submit three (3) copies of the data to the Owner purchaser not later than two (2) weeks before the start date of the SAT. Data to be prepared shall include the following items;

(1) Site acceptance test time schedule.
(2) Check list and formats for the SAT.
(3) SAT procedures.
4. CHECKLIST AND FORMATS FOR SAT

The check lists and formats for the test shall include the following items;

(1) Objective of each test.
(2) Status of subsystem prior to each test.
(3) Reference value or result to be expected of each test.
(4) Actual test value or result during the SAT.
(5) Any alignment or remedial action taken during the SAT.

5. SAT PROCEDURES

The acceptance test shall be executed in accordance with the procurement specification and contractor's proposal including the following items;

(1) Examine whether all the necessary equipments are perfectly installed.
(2) Examine whether all the important system parameters and the related functions are tested.
(3) Quantity inspection.
(4) Flight check is completed.

B. UNSATISFACTORY SAT

(1) Should any part of the site acceptance test be declared unsatisfactory by the Owner the contractor shall replace the disqualified part or component by satisfactory one. The replacement shall be carried out until the completion date of the equipment installation.

(2) In case that a replacement is exceeded the completion date, the contractor shall compensate the Owner for all damages according to the related laws and ordinances.

(3) The contractor shall submit a report to the Owner describing the exact cause and remedial action taken for the unsatisfactory test item.
1.8 EDUCATION AND TRAINING

The contractor shall be responsible for DVOR and DME education and training for Owner’s staffs for both contractor’s factory training and on-site training (On-the-job training). The contractor shall prepare necessary education materials and training aids. All training shall be conducted in the English language and the contractor shall submit the curriculum and training schedule at least two (2) months before the training start date.

A FACTORY TRAINING

(1) The contractor shall provide training for four (4) Owner’s staffs at the manufacturer’s factory. The training course shall be designed to bring up the trainees to a sufficient level for the proper operation and maintenance of the proposed system. The training period of DVOR/DME shall be a minimum of four (4) weeks. The contractor shall provide the round-trip airfare, training fees, education materials, official trip expenses (Hotel fee, meals, daily allowances), etc. Official trip expenses shall be provided in accordance with the guideline of the Civil Service Commission of the Philippines.

(2) The training shall be planned to be completed within one (1) month before the starting of equipment installation.

(3) The contractor shall be responsible for providing transportation facility during the training period on the site.

B ON THE JOB TRAINING

During the on-site shakedown test period, the contractor shall provide on-the-job training for the theory of operation, preventive maintenance procedure, detailed alignment procedure and trouble-shooting techniques of the system. On-the-job training shall be conducted to improve the proficiency level of maintenance staff. Instruction for preventive and corrective maintenance procedures shall be conducted per each individually system with introductions to block diagram and schematic diagram analysis.

The number of trainees and training periods that the Owner required for the on-the-job training courses are as follows.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Weeks</th>
<th>Number of Trainees</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVOR/DME</td>
<td>4</td>
<td>at least 5</td>
<td></td>
</tr>
</tbody>
</table>
C  REQUIREMENT OF FACTORY TRAINING COURSE

All training courses shall include separate chapters for theory practice, and hardware and software. After completion of the training, trainees shall be able to isolate and restore defective hardware modules or cards, and fully understand the architecture of hardware and analysis of operating system and application softwares.

1.9  DOCUMENTATIONS

The contractor shall provide technical manuals and related documents written in the English language.

A.  QUANTITIES OF REQUIRED DOCUMENTS

(1) Installation plan and drawings : 3 copies
(2) System inspection and test reports : 2 copies
(3) Training plan : 1 copy
(4) Training manual and materials : 1 set for each trainee
(5) Technical manuals (English) : 5 copies for each equipment.

B.  TECHNICAL MANUALS

The manuals shall contain the following chapters.

(1) General and functional descriptions for each subsystem.
(2) Equipment installation procedure and Theory of operation.
(3) Preventive maintenance procedures and Corrective maintenance procedures.
(4) Trouble-shooting procedures.
(5) List of bench stock items with their types, part numbers, and quantities.
(6) Parts illustrations and pictures.
(7) Block diagrams and Detailed schematic diagrams.

1.10  COMMISSIONING FLIGHT TEST AND OPERATIONAL TEST RUN

Radio Navigational Aids shall be subject to Flight Test by the Contractor. This test shall conform to those set out in the ICAO Manual Doc. 8071, Annex 10 and Annex 14. The
Contractor will make arrangement for the aircraft and personnel necessary for the flight test. The flight test shall be carried out by the Contractor.

In the event of re-testing by flight to be conducted by the Contractor’s Engineer as a result of any such defects, the Contractor shall make available at the site his personnel to witness the initial flight test.

After the commissioning flight test, the Contractor shall perform the operational test run. The Contractor shall take immediate actions required to correct the operational and functional problems that occurred during the operational test run period. All the corrective actions shall be recorded and the records maintained. The recording files shall include the date and time the problem occurred, cause of failure(s) and a brief description of corrective action to be taken. This record shall be submitted to the Owner.

The cost of all personnel, equipment flight charge, etc., shall be deemed to be include in the Contract price.

1.11 WARRANTY

The contractor shall warrant that no system down or performance degradation will be encountered for three (3) years after the date of final acceptance. During the warranty period, the contractor shall provide materials and technical services without any cost to the Owner. However, the contractor shall be responsible for equipment problems caused by any design and production faults regardless of the warranty period. So when those problems occur, the contractor shall replace required parts of equipment without any cost or compensation.

PART 2 – PRODUCT

The DVOR/DME system to be provided under this specification shall meet the requirements of ICAO Annex 10 (Aeronautical Telecommunications) and Philippine Flight Inspection Procedure (FAA OA P 8200.1 and ICAO Doc. 8071).

2.1 DVOR

A. PERFORMANCE REQUIREMENTS

The DVOR subsystem shall provide bearing information to aircraft. The DVOR shall be constructed and adjusted so that similar instrumental indications in aircraft represent equal clockwise angular deviations (bearings), degree for degree from magnetic North as measured from the location of the DVOR.

The DVOR shall radiate a radio frequency carrier with which are associated two separate 30 Hz modulation. One of these modulations shall be such that its phase is independent of the azimuth of the point of observation (reference phase). The other modulation (variable phase) shall be such that its phase at the point of observation...
differs from that of the reference phase by an angle equal to the bearing of the point of observation with respect to the DVOR. The reference and variable phase modulation shall be in phase along the reference meridian through the station.

1. **Radio Frequency**

   The DVOR transmitter shall be capable of operation on 0.05 MHz increments across the band of 108 to 117.975 MHz. The frequency tolerance of the RF carrier shall be ±0.002 percent over the service frequency band.

2. **Coverage**

   The DVOR shall provide signals such as to permit satisfactory operation of a typical aircraft installation at the heights of 20,000 feet and 25NM distances required for operational reasons, and up to and elevation angle of 40 degrees. In addition, with the transmitter power output reduced to the monitor RF level alarm point, the DVOR coverage shall meet the requirements of the standard Flight Inspection.

3. **Polarization**

   The emission from the DVOR shall be horizontally polarized. The vertically polarized component of radiation shall be suppressed to the lowest possible level.

4. **Bearing Accuracy**

   The nominal of the bearing information conveyed by the horizontally polarized radiation from the DVOR for all elevation angles between 0 and 40 degrees, measured from the center of the DVOR antenna system, shall be between ±1.0 degree (95% probability).

5. **Carrier Modulation**

   The radio frequency carrier as observed at any point in space shall be amplitude modulated by two signals as follows:

   a. A sub-carrier of 9960 Hz of constant amplitude, shall be frequency modulated at 30 Hz and have a deviation ratio of 16 ± 1 (i.e., 15 to 17):

   b. A 30 Hz amplitude modulation component, shall have constant phase with relation to azimuth and constant amplitude, and radiated omni-directionally reference phase.
The depth of modulation of the radio frequency carrier due to the 30 Hz or 9960 Hz signals, as observed at any angle of elevation up to 5 degrees, shall be within the limits of 28 to 32 percent. The percentage of amplitude modulation of the 9960 Hz subcarrier shall not exceed 40 percent when measured at a point at least 300m (1000 ft.) from the DVOR. The sideband level of the harmonics of the 9960 Hz component in the radiated signal shall not exceed the following levels referred to the level of the 9960 Hz sideband:

<table>
<thead>
<tr>
<th>Subcarrier</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>9960 Hz</td>
<td>0 dB reference</td>
</tr>
<tr>
<td>2 harmonic</td>
<td>- 30 dB</td>
</tr>
<tr>
<td>3 harmonic</td>
<td>- 50 dB</td>
</tr>
<tr>
<td>4 harmonic and above</td>
<td>- 60 dB</td>
</tr>
</tbody>
</table>

6. **Identification**

The DVOR shall provide for the simultaneous transmission of a signal of identification on the same radio frequency carrier as that used for the navigational function. The transmission of the identification signal shall not interfere in any way with the basic DVOR function. The identification signal radiation shall be horizontally polarized. The identification signal shall employ the international Morse Code and consist of three or four letters. It shall be sent at a speed corresponding to approximately 7 words per minute. The signal shall be repeated not less than six times per minute and accommodate a repetition rate of two times per minute for the DME. The modulation tone shall be 1020 Hz ± 50 Hz, and the depth of modulation shall not exceed 10 percent.

The identification signal shall be transmitted at all times during which the DVOR is available for operational use. During all times when the DVOR is not available for operational use, as for example during removal of navigational components or during test or maintenance, the identification signal shall be suppressed.

7. **Voice**

The DVOR shall provide a simultaneous communication channel (ground-to-air) on the same radio frequency carrier as used for the navigational function. The peak modulation depth of the carrier on the communication channel shall not be greater than 30 percent.

The audio frequency characteristics of the speech channel shall be within 3 dB relative to the level at 1000 Hz over the range 300 Hz to 3000 Hz.
The transmission of speech shall not interfere in any way with the basic navigational function. When speech is being radiated, the code identification shall not be suppressed.

B. COMPOSITION OF THE DVOR

1. Owner’s Subsystem Concept

A completely equipped DVOR subsystem shall consist of the following. The transmitter and monitor group shall be dual (main and standby).

a. Transmitter with associated modulation, oscillator/keyer.

b. Antenna system with associated cabling, support structure (including counterpoise structure)

c. Monitor with associated FFM antennas and ground check system

d. Equipment building for both VOR and DME

2. Deviations and Exceptions to the above Requirements

If the proposed configuration differs from the above, in order to employ new technology, it shall be stated in the technical proposal in detail for identification and review by the Owner. The following items are primary areas of concern and are given in order of priority.

- Reliability and Maintainability
- Status monitoring and Self-diagnostics
- Convenience for flight inspection: The flight inspection will be conducted in accordance with Philippine Flight Inspection Procedures (FAA OA P 8200.1 and ICAO Doc. 8071). If there are any functions or features intended to promote the convenience of flight inspection. The Contractor should describe them in detail in his technical proposal, in the same order as the Philippine Flight Inspection Procedures.
  - Transmitter group
  - Monitoring group
  - Antenna assembly group
  - Back-up power supply group
2.2 CHARACTERISTICS FOR MAJOR COMPONENTS OF DVOR

A. DVOR TRANSMITTEE

1. Major Blocks of Circuitry

The DVOR transmitter shall consist of the following major blocks of solid state circuitry, each designed to perform those functions hereafter specified:

a. Carrier frequency and power generation – This portion of the transmitter shall contain the following:

   1) RF source to produce the carrier frequency
   2) RF power amplifiers to produce the required power output with amplitude modulation levels herein specified of these audio signals: 9960 Hz FM subcarrier, voice signals 300 through 3000 Hz, identification characters which are keyed 1020 Hz, and 30 Hz.
   3) Automatic level control circuitry shall be contained within the RF transmitter to produce the specified stability.
   4) Automatic phase stability and correction circuitry shall be provided to maintain any preset phase adjustment of the 30 Hz signal applied to amplitude modulate the carrier.

b. Modulator-identification oscillator/keyer

   This portion of the transmitter shall contain the following:

   1) Modulation circuitry to amplitude modulate the carrier signal by 9960 Hz ± 480 Hz, voice 300 through 3000 Hz, identification 1020 Hz, and 30 Hz.
   2) 1020 Hz identification oscillator/keyer to produce the required characters.
   3) Voice identification circuitry

2. Functional Requirements

a. Carrier Power Output

   Each transmitter shall be capable of providing at least 150 watts carrier output into a 50 ohm unbalanced resistive load at the end of a 15m (50 foot) length of ¼ inch RF cable connected at the output of the DVOR transmitter.
b. Carrier Power Output Level Stability and Control

The power output shall be adjustable throughout a range of at least 25 watts to the maximum output of transmitter prescribed by the Contractor with the output automatically maintained within ± 0.5 dB over the range of service conditions.

c. Stabilization of Performance Characteristics and Monitor Response Time

Within 6 seconds after re-application of primary power to the input of the power supply, and in the absence of the battery bank, the power output of the DVOR transmitter shall have reached a level of not less than 90% of the steady state level for the same set of service conditions and all other performance characteristics shall be within their prescribed tolerances. Concurrently each monitor shall have sensed correct operation and provided the appropriate (no fault and non-alarm) output indications.

d. Amplitude Modulation with 9960 Hz Subcarrier

The transmitter shall be capable of being amplitude modulated by the 9960 Hz FM subcarrier to a depth of 30 percent ± 1 percent. With this modulation level, the levels of the harmonics of the 9960 Hz shall not exceed the values indicated:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level Below Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>9960 Hz (reference)</td>
<td>0 dB</td>
</tr>
<tr>
<td>15 kHz through 18 kHz</td>
<td>15 dB</td>
</tr>
<tr>
<td>18 kHz through 27 kHz</td>
<td>32 dB</td>
</tr>
<tr>
<td>27 kHz through 37 kHz</td>
<td>52 dB</td>
</tr>
<tr>
<td>Beyond 37kHz</td>
<td>62 dB</td>
</tr>
</tbody>
</table>

e. Amplitude Modulation with 30 Hz

The transmitter shall be capable of being amplitude modulated by a 30 Hz signal to a depth of 30 ± 1 percent. With this modulated level, the levels of the harmonics of the 30 Hz shall not exceed the values indicated:
### Frequency

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level Below Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Hz (reference)</td>
<td>0 dB</td>
</tr>
<tr>
<td>60 Hz</td>
<td>32 dB</td>
</tr>
<tr>
<td>90 Hz</td>
<td>50 dB</td>
</tr>
<tr>
<td>120 Hz</td>
<td>60 dB</td>
</tr>
<tr>
<td>Beyond 120 Hz</td>
<td>60 dB</td>
</tr>
</tbody>
</table>

f. **RF Output Circuit**

The carrier output circuitry shall be designed to provide the specified performance when feeding the antenna coaxial cable having any values of VSWR in the range of 1.0 through 1.5.

g. **Power Output Measurement**

Directional couplers and detectors shall be incorporated at the carrier output for measurement of forward and reverse power and VSWR.

h. **Power Output Calibration**

The transmitter shall include the necessary modulation circuitry to produce amplitude modulation at the specified levels.

1) **Amplitude modulation** - The transmitter shall be capable of amplitude modulation to depth of 80 percent.

2) **Amplitude modulation level and stability** - The following amplitude modulation levels for the radiated signal shall be established and maintained within ± 1 percent over the range of service conditions:

   a) 9960 FM subcarrier: 0%
   b) Voice peak 300 - 3000 Hz: 30%
   c) 30 Hz AM signal: 30%
   d) 1020 Hz identification: 5%

3) **Phase stability for 30 Hz** - The transmitter shall incorporate phase lock loops (PLL) to automatically maintain the stability of the 30 Hz amplitude modulated signal.
i. Crystals

The DVOR carrier frequency shall be single frequency crystal controlled or synthesized and be adjustable over the full frequency range of 108.0 MHz to 117.975 MHz in steps of 0.05 MHz. The Contractor shall select either one and describe the characteristics and functions with schematic drawing in his Technical Proposal.

j. RF Tuning Adjustments

It shall be possible to tune and adjust the transmitter to meet all performance requirements of this specification on any of the 200 DVOR channels.

k. Identification Oscillator/Keyer

The identification audio signal generator shall provide a sinusoidal 1020 Hz output signal for keyed or continuous tone amplitude modulate the carrier output signal. Interface requirements shall exist for keying of the DME.

1) 1020 Hz Frequency Stability - The stability of 1020 Hz frequency shall be within 50 Hz over the range of service conditions.

2) Harmonic Distortion - The total harmonic distortion of the 1020 Hz audio signal (continuous tone output) shall not exceed 3.0%.

3) Output level and stability - The oscillator/keyer shall provide adjustable levels sufficient to amplitude modulate the carrier output up to 20% without voice modulation (* 10% with voice modulation) with a stability which shall maintain the percentage of amplitude of the carrier output to within ± 1 percent over the range of service conditions.

4) Keyer - The keyer shall operate to key the 1020 Hz audio signal into the dot-dash characters of International Morse Code representing any three or four letter combination of the alphabet. The characters shall be readily programmable.

5) Identification code characteristics - The identification code characteristics shall conform to the following:

a) The dots shall be of duration between 100 milliseconds and 125 milliseconds. The dashed shall be of the duration three times that of the dots.
b) The spacing between the dots and dashed of a code letter shall be equal to the duration of one dot within ± 5 percent.

c) The spacing between consecutive letters of the three or four letter identification code group shall be equal to the duration of three dots within ±5%.

d) The repetition rate for the three or four letter identification code group shall be up to eight times per minute.

6) Synchronization for associated equipment - The keyer shall be programmed to operate in association with DME equipment such that every fourth identification cycle shall cause keying impulses to be provided to the DME. The other identification cycles shall be for the DVOR.

l. Voice input and modulation circuitry

The transmitter shall contain the necessary circuitry to accept voice frequencies in the range of 300 to 3000 Hz, amplify, regulate and provide automatic gain control required to provide amplitude modulation of the carrier output at 30 ± 1 percent. The voice input level shall be adjustable between –30 dBm and + 6 dBm.

m. External input

Provision shall be made for use of an externally generated 30Hz audio signal input for use in amplitude modulation of the RF carrier for Doppler VOR. The 30 Hz external signal source has the following characteristics.

<table>
<thead>
<tr>
<th>Amplitude</th>
<th>Level required to modulate the carrier at any level between 25 and 35 percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplitude stability</td>
<td>±1.0 percent (for any initial adjustment)</td>
</tr>
<tr>
<td>Harmonic distortion (total)</td>
<td>2.0 percent maximum</td>
</tr>
<tr>
<td>Frequency</td>
<td>30 Hz ± 0.1 percent</td>
</tr>
<tr>
<td>Phase stability</td>
<td>+ 0.2 electrical degrees of 30 Hz (with reference to the zero crossovers of the signal)</td>
</tr>
</tbody>
</table>
B. DVOR ANTENNA SYSTEM

1. General Requirements

The DVOR antenna shall radiate carrier and both 9960Hz side-bands simultaneous. To provide for low amplitude modulation on 9960 Hz sub-carrier, the system shall use at least 48 side-bands antennas. The side-band antennas have to be de-coupled to obtain isolations greater 30 dB for low interactions. Each radiating element shall have a high radiation efficiency and high stability to obtain coverage requirements given in ICAO Annex 10. Carrier and Side-band antennas have to be mounted above a circular counterpoise. The counterpoise construction shall be adequate to have a very homogenous conductivity on the surface for the used radio frequency. The height of the counterpoise shall be at least 5m above the ground level and shall be adjustable.

The Contractor shall submit detailed drawings regarding dimensions (diameter, height), material and construction of the counterpoise.

2. Electrical Requirements

The antenna system shall operate in the frequency range of 108 to 117.975 MHz. The horizontal pattern of the antennas shall be omni-directional with tolerances of less than 0.5 dB in amplitude and less than 5 degrees phase deviation from the mean value measured under low elevation.

The radiated co-polarization shall be horizontal whilst the vertical cross polarization component in the horizontal plane shall be at least 40 dB below Co-polarization component. For side-band radiation at least 48 dB antenna ring of adequate size to produce a modulation index of 16 ± 1 have to be provided.

The de-coupling between adjacent antennas shall be independent of feeding conditions which shall be typically more than 30 dB. The amplitude modulation on the 9960 Hz sub-carrier due to interactions when measured at more than 300m from the station shall not exceed 30% peak to peak for elevation angles up to 5 degrees above the horizon.

Each element shall have an input impedance of 50 ohms and a VSWR of less than 1.1.

The space modulation depth of the sub-carrier measured in the horizontal plane and up to an elevation angle of 5 degrees related to the antenna shall be 30 ± 1 percent. The modulation depth of the sub-carrier under elevation angles from 5 to 20 degrees shall be between 25 and 35 percent and within 20 to 40 percent for elevations from 20 to 40 degrees.
The frequency modulation deviation in the 9960Hz sub-carrier decreases with the elevation angle due to the Doppler Principle and shall be not less than 367 Hz at 40 degrees. Peak values in the horizontal plane where the nominal value is 480 Hz shall not exceed ±600 Hz.

The systematic bearing error shall be less than 0.5 degrees measured at 300m distance and an elevation of 3 degree above horizontal and flat terrain. The azimuth accuracy has to be better than ±1 degree measured over flat ground at 3 degrees elevation in more than 300m distance.

The azimuth stability shall be better than ±0.5 degree measured at the monitor.

3. **Mechanical Requirements**

Each radiating element shall be enclosed by a fiberglass reinforced polyester cover for weather protection. The side-band radiating elements shall be equally spaced on the antenna ring and shall have a nominal height of 1.4m above the counterpoise surface.

The antenna support for the reference phasing signal antenna shall be designed to mount the co-located DME antenna at the top. This arrangement shall not impact the performance of the DVOR. The Contractor shall submit detailed drawings for these co-located antennas.

The contractor shall provide all necessary documents such as design drawings, installation specification and foundation calculations.

4. **Obstruction Lights**

A double obstruction lights in accordance with the criteria as specified by the CAAP/DOTC shall be mounted at the top of the DME antenna support. The obstruction light fitting shall house 220 Volt AC 100 watts bulbs wired in parallel.

C. **DVOR MONITORS**

A minimum of two (2) independent monitors should be used for the DVOR, placed at a distance of approximately 90m ~ 200m from the center of the DVOR antenna and be positioned 90 degrees apart in azimuth.

The DVOR monitors must have the ability to self test themselves to ensure their own integrity. The failure of a monitor self-test or the detection of a monitor fault shall cause the DVOR to shut down.

The monitors shall continuously monitor the parameters of the radiated DVOR signal and independently determine if an alarm condition exists. If the monitors are not in a BYPASS status and an alarm condition exist, the monitor shall cause the VOR to
change over or shutdown. Meters and indicators shall be provided on the monitor front panel, displaying all parameters, tolerance and monitor status in accordance with the operating requirements of the system.

The Contractor shall highlight the corresponding part of the proposal by submission of the list or the test result related in order for the Owner to find and review it easily.

1. **30Hz AM and 30 Hz FM Test Point Isolation**

   The 30 HZ am and 30 Hz FM test points shall be isolated from their respective circuits to extent that loading each test point with a 1 megohm resistance will not introduce a phase shift greater than 0.1 degree, nor change the value of modulation of the 30 Hz AM by more than 0.2 percent, nor change the value of 9960 Hz frequency deviation by more than 0.2 Hz.

2. **Input Signals**

   The monitor equipment shall measure all performance requirements with the radio frequency signal field having characteristics and modulation components specified in the tabulation below.

   **Input Signals to Antenna**
   
   RF carrier frequency - 108 to 117.975 MHz

<table>
<thead>
<tr>
<th>Signal Carrier Component</th>
<th>Frequency (Hz)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Hz AM</td>
<td>30 + 1%</td>
<td>20 to 40</td>
</tr>
<tr>
<td>Station Identifier</td>
<td>1020 ± 50</td>
<td>4 to 15</td>
</tr>
<tr>
<td>Voice</td>
<td>300 – 3000</td>
<td>15 to 40</td>
</tr>
<tr>
<td>FM sub-carrier</td>
<td>9960 ± 480 ± 1%</td>
<td>20 to 40</td>
</tr>
<tr>
<td>30 Hz FM</td>
<td>30 ± 1%</td>
<td></td>
</tr>
</tbody>
</table>

3. **Test Signals**

   In ground check operation, the test signal shall be the FM sub-carrier signal.

4. **Ground Check System**

   A ground check system shall be provided. The ground check shall be accomplished by utilizing the input signals from the ground check monitor antennas, the DVOR monitor azimuth measuring circuits and the test signals. It shall be possible to measure the azimuth error of the radiated signal to the nearest 0.1 degree.
The Contractor shall provide a detailed description for the proposed ground check system, in the Technical Proposal, including the ground check procedures, ground check results, storage and ground check alarm condition.

5. **Monitor Antenna**

The antennas shall include all elements necessary to receive the radiated DVOR signal, and shall be assembled so as to enable the Contractor in the positioning of the elements in the radiated field. The monitor antenna system shall not derogate system performance of DVOR. The Contractor shall recommend the location of the monitor antenna after completing the site survey.

a. **Broadband characteristics** - The monitor antennas shall have broadband characteristics such that the performance requirements are monitored over the frequency range of 108 - 117.975 MHz without requiring any readjustment to the antenna.

b. **Phase balance** - The monitor antenna output shall be balanced with respect to RF phase to RF phase in such a manner that the indications of the phase difference between the 30 Hz components of the input signal will not differ by more than 0.1 degree.

c. **Polarization** - The antennas shall be horizontally polarized. Vertical polarized radiation shall beat least 12 dB below horizontal polarized SIGNALS.

d. **Dipole Antenna** - The dipole antenna shall consist of two elements of minimum length constructed of monel metal or stainless steel. A nonmetallic top element should be fitted above the dipole to stop birds perching on the dipole.

The Contractor shall highlight the corresponding part of the proposal by submission of the list or the test result related in order for the Owner to find and review it easily.

e. **Antenna Mast**

1) **Mast Cable Slot** - The mast shall be provided with a slot located 90cm to 101cm (35 to 40 inches) below the antenna. The slot shall allow passage of the coaxial cable with a terminating plug attached.

2) **Cable Clamp** - Suitable means shall be provided for clamping the cable within the antenna housing and mast to prevent damage due to strain.
f. **Protective Enclosure** - A plastic enclosure fabricated from fiberglass reinforced material shall be provided to prevent birds, insects and rain from coming in contact with the antenna elements.

The Contractor shall describe the shape, and material used and the effectiveness of the proposed protective enclosure with appended associated drawing and photos.

g. **Monitor Antenna / Monitor Interconnecting Cables** - The interconnecting cable between the antenna and monitor shall be ¼ inch RF cable, and its length shall comply with standard commercial practice, and shall meet the performance requirements of the monitor specified in this specification.

6. **Monitor**

The monitor shall have the capability to monitor DVOR operating status and shall have necessary solid state circuits:

a. **Aural Channel**

1) **Level Control** - A manual level control shall be provided on the front panel of the monitor to allow adjustment of the headphone output. The control shall be marked “AUDIO LEVEL” or equivalent words.

2) **Effect on Monitored Signal Components** - Adjustment of the AUDIO LEVEL control, throughout the entire range, shall not change levels of the 1020 Hz modulation, the FM sub-carrier, or the 30 Hz AM by more than 2 percent, nor introduce an azimuth shift that exceeds 0.05 degree.

3) **Aural Output** - An output of the aural channel shall be connected to the Remote Control and Monitor Room (via an analogue telephone channel) and to the headphone output.

4) **Rated Load** - The rated load for the aural output shall be a 600 ohm ± 5 percent resistive load.

5) **Output Power** - The output power shall be at least +11 dBm throughout the range of 300 Hz to 3000 Hz.

6) **Output Stability** - The output power shall remain stable within ±dB over the range of service conditions.

7) **Audio Distortion** - The total harmonic distortion in the range of 300 Hz to 3000 Hz shall not exceed 4 percent at
rated output.

8) **Hum and Noise** - The total hum and noise level shall not exceed 24 dBm at all settings of the level control.

b. **Isolation from the 30 Hz AM Signal**

The level of the 30 Hz AM signal in the 30 Hz FM channel shall be at least 60 dB below the level of 30 Hz AM signal at the output of the AM detector.

c. **Detector Signal Harmonics**

The level of harmonics of the detected 30 Hz FM signal, as measured at the input of the sage following the detector, shall be at least 60 dB below the fundamental.

d. **Azimuth Selection**

It shall be possible to select the azimuth reference between 000.0 and 359.9 degrees in 0.1 degree increments via the monitor CPU to terminal interface or the RICE interface.

e. **Zero Adjustment**

The DVOR monitor microprocessor shall automatically components for the inherent phase difference between the two 30 Hz channels. The phase difference compensation shall be displayable.

f. **Accuracy of Azimuth Indication**

The azimuth indication at the FCPU interface shall be accurate to within ± 0.05 degrees, readable to 0.1 degree for all azimuth inputs.

g. **Fault Circuits**

The requirements of the following subparagraphs shall apply to the fault circuits.

1) **Azimuth Fault** - It shall be possible to set the azimuth fault limit between 0.1 and 1.9 degrees in 0.1 degree increments over the range from 000.0 through 359.9 degrees. The measured azimuth shall be compared to the reference azimuth. When the magnitude of the difference between those two values exceeds the value of the azimuth fault limit, a fault condition shall exist.

2) **30 Hz AM Modulation Fault** - It shall be possible to set the
30 Hz AM modulation reference point (nominal 30 percent) between 20 and 40 percent modulation and to set the 30 Hz AM modulation fault limit between 2 and 8 percent. The measured 30 Hz modulation shall be compared to the 30 Hz AM modulation differ from the reference point by a magnitude equal condition shall exist.

3) **Side-band Antenna Signal Level Fault** - It shall be possible to set the side-band antenna signal level reference point (nominal 0 dB) and to set the fault limit between –1.5 dB and –2.0 dB. The measured side-band antenna signal level shall be compared to the reference. When the measured value of the side-band antenna signal level differs from the reference by a magnitude equal to or greater than the fault limit, a fault condition shall exist.

4) **FM Sub-carrier Frequency Deviation Fault** - It shall be possible to set the maximum frequency deviation excursion reference point (nominal 480 Hz) of the 9960 Hz FM sub-carrier between 424 and 536 Hz, and to set the FM sub-carrier frequency deviation fault limit between 8 and 40 Hz in 8 Hz steps. The measured FM sub-carrier frequency deviation shall be compared to the FM sub-carrier frequency deviation reference to determine fault conditions.

5) **Identification Fault** - The system shall monitor the 1020 Hz identification signal. The monitored identification code as set. When the monitored identification signal does not agree with the code as set, an alarm condition shall exist.

6) **Field Intensity Fault** - It shall be possible to set the nominal relative field intensity reference point and to set the relative field intensity fault limit between 1 and 9 dB. The measured relative field intensity shall be compared to the reference field intensity. When the measured value of the field intensity is less than the reference field intensity by a magnitude equal to or greater than the field intensity fault limit, a fault condition shall exist. The stability of the field intensity measurement shall be ±1.0 dB.

7) **Main Alarm Output** - An alarm output circuit shall be provided to initiate shutdown of the DVOR transmitter. An adjustable control shall be accessible to provide an alarm indication within 4 to 10 seconds of a fault condition. Once set, the alarm time shall remain constant within 0.1 second.

8) **Alarm By-pass Control** - An alarm bypass control shall be
provided and connected to prevent shutdown and remote indication of alarm, when activated. The bypass switch and an amber LED on the transmitter front panel shall indicate when the monitors are bypassed. Indication of bypass condition shall be provided to the remote control site.

h. Remote Readout

The following shall be readable remotely at the Remote Control and Monitor Room:

1) Azimuth to hundredths of a degree
2) 30 Hz and FM sub-carrier (9960 Hz) modulation to percent modulation
3) 30 Hz AM frequency to tenths of a Hertz
4) FM sub-carrier frequency deviation to 5Hz
5) Relative field intensity in tenths of decibels (both antennas)
6) Status of monitor alarm bypass
7) Side-band antenna signal level
8) Status of Monitor System

i. Fault Setting Tolerances

The present limits for fault detection shall have the following tolerances.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Azimuth</td>
<td>± 0.1 degree</td>
</tr>
<tr>
<td>30 Hz AM modulation</td>
<td>± 1 percent</td>
</tr>
<tr>
<td>FM sub-carrier modulation</td>
<td>± 1 percent</td>
</tr>
<tr>
<td>FM sub-carrier frequency modulation</td>
<td>± 5 Hz</td>
</tr>
<tr>
<td>Field intensity</td>
<td>± 1 dB</td>
</tr>
</tbody>
</table>

j. DVOR auto-reset function

The DVOR monitor shall include firmware which will automatically reset the systems and continue normal operation if there are not more than three alarms within any 15 minute period. If a fourth alarm
occurs during any 15 minutes period, no further auto-resets would be attempted. Automatic reset shall not be initiated for alarms generated by the DVOR 16-point executive monitor function.

The initial reset shall occur 20 seconds (± 2 seconds) after the first alarm condition. If the system remains stable for 15 minutes (±2 seconds) after the reset occur, the auto-reset function shall be restored to its full enable state.

If the system does not reset to normal, or if another alarm (second) occurs prior to the end of the initial 15 minute period, another attempt to reset shall be initiated 32 seconds (± 3 seconds) after the initial reset attempt or after a new alarm. If the reset is successful and the system remains stable for 15 minutes (±2 seconds) after the reset occurs, the auto-reset function shall be restored to its full enable state.

If the system does not reset to nominal or if another alarm (fourth) occurs prior to the end of the initial 15 minute period, no further auto-resets shall be attempted and operator intervention shall be required to restore the system to normal and to return the auto-reset function to its full enable state. Notification of all alarm conditions and reset attempts shall be provided to the control point at the maintenance work center.

Override timing and counter circuitry shall be provided to ensure that regardless of the status of the auto-reset, the system shall not restore to normal if there are more than three alarms in any 15 minute period.

k. Monitor Fail-Safe

The DVOR monitors shall be fail-safe such that failure of any parts of the monitors shall either result directly in an alarm condition, or shall not alter any alarm threshold level such as to allow an out-of-tolerance condition to occur. This fail-safe requirement shall be verified during the site acceptance test.

2.3 DME

A. PERFORMANCE REQUIREMENTS

The DME subsystem shall be solid state, and shall provide for continuous and accurate cockpit indication of the slant range distance of an aircraft from the DME ground reference point. The interrogator in the aircraft generates a pulsed signal (interrogation) which is detected by the ground DME transponder. In turn, the transponder generates pulsed signals (replies) which are sent back and detected by the interrogator’s tracking circuitry. Distance is then computed by measuring the round trip time of the interrogation and its reply. The operation of DME is accomplished by
paired pulse signals and the recognition of desired pulse spacing accomplished by the use of a decoder. The transponder must reply to all interrogators.

1. **Radio Frequency**

The DME transponder shall be capable of operation in 1 MHz increments across the band 960 to 1215 MHz. The frequency tolerance of the RF carrier shall be ±0.001 percent over the service conditions.

2. **Coverage**

The coverage of the DME shall be at least that of the DVOR (25NM).

3. **Polarization**

The emission from the DME shall be vertically polarized.

4. **System Accuracy**

The error sources in the DME ground equipment shall be minimized in order that the total system error does not exceed ±0.2 NM (95% probability). (Total system error includes the contribution from the ground equipment, airborne equipment, propagation and random pulse interference effects.) The allocation for the airborne equipment shall be assumed to be ±0.17 NM (95% probability).

5. **Pulse Characteristics**

The DME transmitter shall have the following pulse characteristics.

a. Pulse rise time - shall not exceed 3 microseconds
b. Pulse duration - shall be 3.5 microseconds ± 0.5 microseconds
c. Pulse decay time - shall not exceed 3.5 microseconds
d. Pulse pair spacing 12 microseconds ± 0.25 microseconds for “X” CHANNELS

6. **Identification**

The identification signal for the DME shall consist of the transmission of a series of paired pulses transmitted at a repetition rate of 1350 pulse pairs per second. The identification pulses shall temporarily replace all reply pulses that would normally occur at that time, except that reply pulses shall be
transmitted between key down times. The identification pulses shall have similar characteristics to the other pulses of the reply signals. The identification signal shall only be transmitted during periods of keying (Morse Code dot or dash) provided by DVOR or by the internal DME keyer. The signal shall be repeated not less than two times per minute.

The identification signal shall be transmitted at all times during which the DME is available for operational use. During all times when the DME is not available for operational use, as for example during removal of navigational components or during test or maintenance, the identification signal shall be suppressed.

B. COMPOSITION OF DME

1. Owner’s Sub-system Concept

   A completely equipped DME system shall consist of the following. The transponder and monitor group shall dual (main and standby).

   a. Transponder with associated duplexer, receiver, coder and transmitter equipment
   b. Antenna with associated signal coupling probes, cabling and support structure
   c. Monitor with associated directional couplers, interrogation signal generator and video pulse generator

2. Deviation and Exceptions to the Above Requirements

   If the proposed configuration differs from the above, in order to employ new technology, it shall be stated in the Technical Proposal in detail for identification and review by the Owner. The following items are primary areas of concern.

   • Reliability and Maintainability
   • Status monitoring and Self-diagnostics.
   • Convenience for flight inspection: The flight will be conducted in accordance with Philippine Flight Inspection Procedure (FAA OA P 8200.1 and ICAO Doc. 8071). If there are any function or feature intended to promote the convenience of flight inspection. The Contractor should describe them in details in his Technical Proposal, in the same order as the Philippine Flight Inspection Procedures.
• Transponder group
• Monitor group
• Antenna assembly group
• Back-up power supply group

2.4 CHARACTERISTICS FOR MAJOR COMPONENTS OF DME

A. TRANSPONDER

The transponder when operate in conjunction with the DME antenna shall produce
and radiate International Morse Code identification signals, receive and decode
interrogation signals and, in response thereto, radiate a properly cored reply pulse
pair after a specific reply delay time. Produce and radiate random pulse pairs in
addition to above, sufficient in number to maintain a minimum output pulse count of
1350 ± 150 pulse pairs.

1. Frequency Source

The DME shall employ a signal frequency crystal oscillator or frequency
synthesizer whereby any required frequency is derived from a signal
frequency determining component. Means shall be provided to prevent
radiation of an RF output signal on other than the desired channel frequency
due to malfunction of the frequency generation circuits. The Contractor shall
select either frequency source and describe the characteristics and functions
with the associated schematic drawings in his Technical Proposal.

Each unit of equipment shall be tuned and adjusted for operation on a channel
(operating frequency) assigned by the Owner.

2. Operating Channels

Transponders shall provide the specified performance on each of the channels
and modes listed in Table A of Part 1 of ICAO Annex 10 when the proper
frequency channel is selected.

3. RF Tuning

Each RF device shall be capable of operating on any channel assignment
within its design range without the need for re-tuning.
4. **Duplexer**

A duplexer shall be provided to permit simultaneous operation of the receiver and transmitter on a signal antenna. The duplexer shall be of the passive type. No adjustment to the duplexer shall be required in order to achieve the performance required throughout the 960 – 1215 MHz DME band.

5. **Receiver and Associated Video Circuitry**

All performance requirements specified hereinafter which involve interrogation signal(s) shall be have any value from threshold triggering level to not less than –10 dBm as referenced to the transponder antenna transmission line connector.

a. **Receiver Bandwidth and Stability**

   The bandwidth of the receiver and the stability thereof shall be such that the threshold sensitivity is not reduced by more than 3 dB when the total receiver drift in either direction is added directly to an interrogation signal frequency deviation of 100 kHz in the opposite direction.

b. **Receiver Decoder**

   The decoder shall decode and produce an output pulse from interrogation signal pulse pairs occurring at spacing within the range of 12 ± 0.5 microseconds for channel numbers ending in the suffix “X”.

c. **Receiver Dead Time**

   Each decoded pulse shall result in the generation of a dead time interval during which time the transponder shall not reply to any other signals at any and all levels up to –10dBm. The dead time interval shall be adjustable throughout the range of 50 microseconds. The dead time normally be generated by received and decoded interrogation pulse pairs.

d. **Reply Efficiency**

   Two (2) sets of performance requirements are specified below. The first (subparagraph 1) below) applies when the transponder is operated to provide a maximum number of replies interrogations of 2700 ± 90 pulse pairs per second. The second (subparagraph 2) below) applies when the transponder is operated to permit as many as 5000 replies to interrogations.
1) **Present Duty Cycle** - In the absence of the other interrogations, the receiver and its associated video circuitry shall provide a reply efficiency of not less than 85 percent (80 percent for “Y” channel) to the interrogation of a signal aircraft (30 pps) when the level of interrogating signal is 10 dB above the threshold sensitivity level. In the presence of additional interrogations of 2970 pps (3170 for “Y” channel) having signal levels above the threshold sensitivity level, including levels as high as –70 dBm, the reply efficiency to the same signal aircraft interrogation shall not be less than 70 percent (70 percent for “Y” channel) with a receiver dead time setting of 60 microseconds and with the echo suppression circuit disabled.

2) **Increased Traffic Handling** - The requirements 1) above shall apply. When the number of additional interrogations in increased to 7670 pps (9070 for “Y” channel), the reply efficiency shall not be less than 60 percent (50 percent for “Y” channel).

6. **Coder and Associated Circuitry**

Circuitry associated with the coder shall accomplish gating, timing, and coding of the distance reply and identify RF output signals produced by the transmitter. The coder shall utilize the decoded reply pulse (or squitter) outputs of the receiver and Morse code keying from the operating DVOR transmitter or from the internal DME keyer.

a. **Priority of Transmission**

The order of precedence for transmission of the output signal pulse shall be:

1) Identity pulses

2) Distance reply or squitter pulse pairs.

Distance reply (or squitter) pulse pairs shall not be transmitted during the interval (Morse code dot or dash) of transmission of identification signal pulse groups.

b. **Reply Pulse Coding**

Reply pulses shall be coded in pairs with a spacing as measured between the 50 percent maximum voltage amplitude point on the leading edge of the first RF pulse to the corresponding point on the
leading edge of the second RF pulse, of 12 (± 0.25) microseconds for channel numbers ending in the suffix “X”.

c. Reply Delay

Means shall be provided to set the nominal reply delay time to within 0.0625 microsecond of any desired value between the limits of 35 to 51 microseconds on “X” channels (46 to 62 microseconds on “Y” channels).

d. Identification Signal

The identification signal shall consist of a group of two pulses at a basic repetition rate of 1350 ± 10 pps. Each group shall consist of one pair of pulses spaced at 12 or 30 µs (first pulse to first pulse). The time of occurrence of the identification groups shall be governed by the 1350 Hz tone generator. A separate, internal 1350 Hz source shall be provided. The internal source shall have a frequency and stability of 1350 ± 5 Hz.

7. Identification Keying

Under normal operation, identification keying of the DME shall be accomplished by means of the identification keyer of the operating DVOR equipment, resulting in keying of the DME during each fourth cycle (approximately once each 30 seconds), during which keying of the DVOR is omitted. In addition thereto, each DME equipment shall be provided with its own internal keyer to allow the DME to continue in operation upon failure of the DVOR. In the event of a DME identification fault when a malfunction of the DVOR Identification keyer or associated wiring and switching extend to the DME equipment. The keying characteristics (Morse code word and character length, and repetition rate) shall be the same as for the DVOR identification keyer except that the DME keyer shall key at 30 sec. intervals.

8. Transmitter and Associated Circuitry

Each DME transmitter and associated modulator and power supply circuit shall provide the following performance and output signal characteristics.

a. DME Transmitter

1) **Pulse shape** - The RF envelope of each pulse, as detected by a linear detector, shall have a smoothly rounded shape falling within the following limits.

   a) Pulse Rise Time - The rise time shall not exceed 3 microseconds.
b) Pulse Top - The instantaneous amplitude of the pulse shall not, at any instant between the point on the leading edge which is 95 percent of the maximum amplitude, fall below a value which is 95 percent of the maximum voltage amplitude.

c) Pulse Duration - The pulse duration shall be nominally 3.5 ± 0.5 microseconds.

d) Pulse decay time - The decay time shall be 2.5 ± 1.0 microseconds, but will not exceed 3.5 microseconds.

2) **Power Output** - The power output at the peak of each pulse shall not be less than a level of 1000 watts as measured at the output of the equipment cabinet. The DME shall also meet all specification requirements when the power output, as measured at the point of the equipment cabinet, is setup for 100 watts operation.

3) **Pulse Power Variation** - The difference in power level at the peak of constituent pulses of any pulse pair shall not exceed 1 dB.

4) **RF Output Control** - Means shall be provided to permit continuous adjustments of the RF output power in 0.25 dB steps from a preset level 100 watts or from a preset level of 100 watts over the range of 0 to –6 dB, respectively. All transponder output signal requirements shall be met throughout the specified range of power output levels without the need for readjustment of any other controls. The power output shall be automatically maintained within ± 0.5 dB over the service conditions. The power output shall be set, to provide a signal density of at least –89 dBW/m² at the limits of the service area.

5) **RF Pulse Signal Spectrum** - The pulse signal spectrum of the transmitter output signal shall be such that the power contained in a 0.50 MHz band centered on frequencies 0.80 MHz above and below the nominal reply frequency is in each case at a level which is not less than 47 dB below the power contained in a 0.50 MHz band centered on frequencies 2.0 MHz above and below the nominal reply frequency shall in each case be at a level which is not less than 67dB below the power contained in a 0.50 MHz band centered on the nominal reply frequency. All other like bans of the spectrum which are further removed from the reply frequency shall have lower levels of power therein than the adjacent bans.
nearer the reply frequency.

6) **Spurious Output** - At all frequencies from 27 to 1660 MHz, but excluding the band of frequencies from 960 to 1215 MHz, the spurious output as measured at the antenna transmission line connector shall not exceed \(-40 \text{ dBm/kHz}\) of receiver bandwidth.

7) **Inter-pulse Output Level** - The RF output level during the interval between occurrence of the desired pairs shall not exceed a level which is 80 dB below the maximum power level during the pulse. In addition the pulses of each pair there shall be an interval of 1.0 microsecond or greater length during which the maximum power level of each pulse.

8) **Duty Cycle** - The transmitter shall have a capacity for providing as many as 10,300 signal pulses per second.

b. **Thermal Protection**

Protection shall be provided to prevent damage to the transmitter in case of an, over temperature condition (such as a cooling fan failure). Means shall be provided to reset the system to the operating conditions if a system shutdown occurs due to an over temperature condition.

c. **Stabilization of Performance Characteristics and Monitor Response Time**

Within 6 seconds after re-application of primary power to the input of the power supply, and in the absence of the battery bank, the power output of the DME transmitter shall have reached a level of not less than 90 % of the steady state level for the same set of service conditions and all other performance characteristics shall be within their prescribed tolerances. Concurrently each monitor shall have sensed correct operation and provided the appropriate (no fault and non-alarm) output indications.

**B. DME ANTENNA**

1. **Antenna Design**

The type of antenna provided shall be an omni-directional antenna. And all requirements specified shall apply through the frequency band of 960 through 1215 MHz without tuning or adjustment. The antenna shall be manufactured to stabilize the facility performance under all weather conditions.
2. **Polarization**

The antenna shall be vertically polarized.

3. **Antenna Impedance**

The antenna shall have a nominal impedance of 50 ohms.

4. **VSWR**

The antenna shall have a maximum VSWR of 2:1.

5. **Radome and Weather-Proofing**

The radome shall be smooth and shall minimize wind loading and the accumulation of water and etc.

6. **Antenna Cable**

The Contractor shall furnish antenna coaxial cables and connectors that are endurable in all weather conditions.

C. **DME MONITOR**

The monitor shall provide for the executive monitoring of the DME system to the criteria (key parameters) specified hereinafter. The monitor shall also examine and measure such other parameters of the operating system as required for maintenance monitoring and test purposes including self-testing of monitor alarm limits through the use of built-in test equipment internal to each monitor and also in response to test signals from the Monitoring and control subsystem CPU. The following paragraphs identify requirements for the monitor equipment and associated circuitry.

1. **Operating Channels**

Monitors shall provide the specified performance on each of the channels and modes listed in Table A of Part 1 of ICAO Annex 10 when the proper frequency channel is selected. In addition to providing an output on the assigned channel interrogation frequency for the interrogation signal generator, the frequency generation circuits shall also provide for outputs of ±200 kHz and ±900 kHz removed from the assigned channel interrogation frequency for the test purposes.
2. **RF Tuning**

Each RF device shall be capable of operating on any channel assignment without the need for re-tuning.

3. **Channel Frequency Accuracy and Stability**

The specified accuracy and stability shall apply identically to the selected channel and to the ±200 and ±900 kHz outputs of the interrogation signal generator.

4. **Monitor RF Input and Output Signal Coupling**

a. **Interrogation Path**

Each monitor shall provide for interrogation of the transponder for test purpose through command the FCPU via a 30 dB directional coupler.

b. **Reply Path**

1) **Antenna Transmission Line/Transponder Output** - Most signal parameters shall be monitored via the (nominal) 30 dB directional couplers. Each monitor shall provide for sampling the replies of the transponder in response to the interrogations of the monitor.

2) **RF Input Levels** - All monitor performance requirements shall be met when the transponder has any initial RF output power level of between 50 and 1000 watts peak (0.05 to 1 watt input to the monitor with nominal 30 dB coupling factor).

3) **Ladiated Signal** - DME signal parameters (identified hereinafter) not monitored by means of directional couplers located in the antenna or transponder output transmission line shall be monitored by means of signal coupling probes (two each) in the DME antenna base. Input RF connections shall be provided to connect to the DME coupling probes.

4) **DME Antenna Coupling Probes** - All performance requirements of the DME monitor shall be met when the RF input to the monitor has any initial level between +17 dBm and +33 dBm.
c. Directional Couplers

Directional couplers shall have a nominal coupling factor of 30 dB (including the attenuation of the connection cable to the monitor), and a directivity of not less than 20 dB. Couplers shall have an accuracy of ±0.50 dB under normal test condition, over the frequency range of 960 through 1215 MHz. Coupling factor shall not vary by more than ±0.5 dB over the service conditions.

5. Key Monitored Signal Parameters

The Contractor shall describe in his Technical Proposal regarding the functions and characteristics of major parameters for the products which will be provided.

The following is a list of key signal parameters that shall provide the specified fault and alarm indications and actions.

a. Monitor Parameter and Alarm Action

1) **The key parameters required to be stopped for DME operation** - The DME shall be programmed to be stopped immediately when and alarm is detected on the following parameters.

   a) Transponder output (refer 2.1 C5b1)

   b) Radiation output level (Output from coupling probes from DME antenna) (refer 2.4C5b2)

2) **Parameters to activate transfer to dual encoder circuitry** - The DME shall be programmed to be changed over or stopped by an alarm caused by any of the following out-of-tolerance parameters. The first alarm shall result in transfer of operation to the dual encoder. If the alarm is the second then the DME shall be shut down.

   a) Reply delay

   b) Output pulse spacing

   c) Receiver sensitivity

   d) Transponder output pulse rate

   e) Identification
b. **Key Parameter Detailed Requirements**

1) **Transponder Power Output Monitor** - The transponder power output monitor shall respond to the amplitude level of transponder output pulses as provided by the transmission line directional couplers. A fault threshold shall be reached whenever the peak power level of the signal decreases to any pre-selected level within -1.0 to -6.0 dB relative to any initial value given in paragraph 2.4C4b2). The fault threshold point shall have a stability of ±0.5dB. After the sensing of a fault, an increase of 0.5 dB in the transponder output as referenced to the fault, and all greater increase, shall end the fault indication.

2) **Radiated Power Level Monitor** - The radiated power output monitor shall respond to the amplitude level of antenna radiated output pulses as provided by the DME antenna coupling probes. A fault threshold shall be reached whenever the peak power level of the signal decreases to any pre-selected level with -3.0 to -8.0 dB relative to any initial value given (paragraph 2.4.C.b.4).

3) **Reply Delay Monitor** - The reply delay monitor shall measure the position of reply pulses transmitted in response to the higher-level outputs of the interrogation signal generator. The fault threshold point shall be reached whenever the reply delay deviates from its nominal setting by ±0.6 microseconds and more. The performance of the reply delay monitor shall not be sensitive to the interrogation rate of the monitor signal generator nor to the percentage of replies to monitor interrogation for reply efficiencies as low as 50 percent. The reply delay monitor shall, however, provide a count of the number of replies to monitor interrogation and provide a measure of reply efficiency for remote maintenance monitoring purposes.

4) **Output Pulse Spacing Monitor** - The output pulse spacing monitor shall measure the spacing of the transponder output pulse pairs. The fault threshold shall be reached whenever the spacing deviates from the nominal value for the channel assigned (12.0 (±0.5) μS or more for X Channel, 36.0 (±0.5) μS or more for Y channel).

5) **Receiver Sensitivity Monitor** - The receiver sensitivity monitor shall measure the percentage of replies transmitted in response to the lower-level outputs of the interrogation
signal generator. The fault threshold level shall be adjustable between the limits of 50 to 70 percent. The adjustment shall either be continuous or in increments of not greater than 2.5 percent. Fault (and alarm) conditions shall be provided in accordance with the following:

a) Within 15 seconds (90 percent confidence level) when the true reply efficiency is 10 percentage points below the threshold setting.

b) Within 30 seconds (90 percent confidence level) when the true reply efficiency is 5 percentage points below the threshold setting.

c) Within 30 seconds (50 percent confidence level) when the true reply efficiency is 2.5 percentage points below the threshold setting.

d) Not more frequently than one in 2.5 hours when the true reply efficiency is 2.5 percentage points above the threshold level.

e) Not more frequently than once in 720 hours when the true reply efficiency is 5.0 percentage points above the threshold level.

6) **Transponder output pulse rate monitor** - A fault condition shall exist whenever the transponder output pulse rate decreases to 850 (±100) pps and lower values.

7) **Identification Keying Monitor** - The identification keying monitor shall sense the presence of periodic identification keying of the transponder through recognition of the fundamental frequency fault (alarm) condition shall exist whenever a time of 45 seconds has elapsed timing interval shall be reset to zero upon each:

a) Restart of DVOR after shutdown

b) Restart of DME after shutdown

c. **Alarm delay**

Except for those monitored parameters for which fault and alarm are synonymous or for which longer times are specified, a fault condition shall be permitted to exist for a period of time adjustable between 4.0 and 10.0 seconds prior to initiation of alarm action. Once set, the stability of the alarm delay time shall be within 1.0 second.
6. Interrogation Signal Generator

The interrogation signal generator shall provide RF interrogation signals for the monitoring of the operating transponder or for the testing of the operating transponder. In the normal mode of operation, when functioning as part of the executive monitor, the interrogation signal generator shall provide on-channel frequency RF interrogation pulse pairs at fixed levels, spacing, and interrogation rate for the monitoring of the reply delay and receiver sensitivity parameters. The signal generator shall also provide the capability, upon command from the MAC CPU of interrogating at off-channel frequencies, alternate RF levels, pulse spacing, and interrogation rates for the measurement and certification of other specified performance characteristics of the transponder.

a. RF Output frequencies

The center frequency shall be used for normal monitoring purposes. The ±200 kHz frequencies shall be used for the testing of transponder receiver bandwidth and the ±900 kHz frequencies shall be utilized for the testing of adjacent channel rejection.

b. Spurious output

At all frequencies from 27 to 1600 MHz, but excluding the band of frequencies from 1023 to 1152 MHz, the spurious output as measured at the RF output connector of the signal generator shall not exceed –40 dBm/kHz of receiver bandwidth. In addition, the power at the RF output connector during the intervals between occurrence of the desired interrogation pulse pairs shall not exceed a level of –80 dBm for all settings of the output attenuation.

c. RF output pulse shape

The RF output pulse shape shall conform to the following:

1) Pulse rise time - The pulse rise time from the 10% point to the 90% point of the maximum voltage amplitude on the leading edge of the pulse is not less than 1.5\,\mu\text{s} nor more than 3.0\,\mu\text{s}.

2) Pulse Top - The instantaneous amplitude of the pulse does not, at any instant between the point on the leading edge which is 95% of the maximum voltage amplitude and the point on the trailing edge which is 95% of the maximum voltage amplitude, fall below a value which is 95% of the maximum voltage amplitude.
3) **Pulse Duration** - The pulse duration, from the 50% point of the maximum voltage amplitude on the leading edge of the pulse to the 50% point of the maximum voltage amplitude on the trailing edge of the pulse is 3.5 ± 0.5 µS.

4) **Pulse Decay Time** - The pulse decay time, from the 90% point to the 10% point of the maximum voltage amplitude on the trailing edge of the pulse is not less than 1.5 µS nor greater than 3.0 µS.

d. RF output pulse spacing

Pulses are coded in pairs with a spacing as measured between the 50% maximum voltage amplitude point on the leading edge of the first RF pulse to the corresponding point on the leading edge of the second RF pulse, of (12.0 (±0.5) µS or more for X Channels, 36.0(±0.5) µS or more for Y channels).

e. RF output level

The signal generator shall be capable of providing RF output pulse levels at the output connector throughout the range of 0 dBm through -80 dBm (-30 dBm through -110 dBm at the transponder receiver input). A stability of ±1.0 dB shall apply to any selected output level. During normal monitoring operation the signal generator shall provide two fixed levels of output on a time sharing basis, a high level output for the monitoring of reply delay and a lower level output for the monitoring of receiver sensitivity.

1) High output level - The high output level shall be set at -30 dBm (-60 dBm at the transponder receiver input).

2) Low output level - The low output level shall have a range of initial adjustment between –25 dBm and –80 dBm (-55 dBm and 110 dBm at the transponder input).

3) Test output levels - During test operation the signal generator shall provide pulsed or CW outputs at the various levels required for the measurement of transponder receiver performance requirements.

f. Output PRF

The output PRF in the normal monitor mode of operation shall not exceed 30 pps, of which up to 80 percent shall be permitted to be at the high output level. In the test mode of operation for the those measurements involving the percentage of replies to desired signals
the number of interrogations shall not exceed 400 pps. For tests requiring the simulation of traffic loading or undesired off-channel pulses, the signal generator shall be capable of providing output pulse rate anywhere within the range of 10 through 10,000 pps.

7. Video pulse generator

The video pulse generator shall provide simulated transponder output pulse pairs for alarm limit certification of the following monitored parameters:

a. Reply delay
b. Reply pulse spacing
c. Receiver sensitivity (percent replies)
d. Output pulse rate

In response to signal from the MAC CPU, the video pulse generator shall automatically provide pulses having the required (variable) pulse pair spacings and PRFs for testing of alarm limits over the specified ranges. For the testing of items ‘a’ and ‘c’ the simulated reply pulses shall be synchronous with the monitor interrogation pulses and variable in time delay thereto for the testing of item ‘a’ and randomly counted down in number for the testing of item ‘c’.

8. DME auto-reset function

The DME monitor shall include firmware which will automatically reset the system(s) and continue normal operation if there are no more than three alarms within any 15 minute period. If a fourth alarm occurs during any 15 minutes period, no further auto-resets would be attempted.

The initial reset shall occur 20 ± 2 seconds after the first alarm condition. If the system remains stable for 15 minutes ±2 seconds after the reset occurs, the auto-reset function shall be restored to its full enable state.

If the system does not reset to normal or if another alarm condition. If the system remains stable for 15 minutes period, another attempt at reset shall be initiated 32±3 seconds after the initial reset attempt of after the new alarm. If the reset is successful and the system remains stable for 15 minutes ±2seconds after the reset occurs, the auto-reset function shall be restored to its full enable state.

If the system does not reset to normal or if another alarm (third) occurs prior to the end of the initial 15 minute period, another attempt at reset shall be
initiated 70±5 seconds after the last reset attempt or the new alarm. If the reset is successful and the system remains stable for 15 minutes ±2 seconds after the reset occurs, the auto-reset function shall be restored to its full enable state.

If the system does not reset to normal or if another alarm (fourth) occurs prior to the end of the initial 15 minute period, no further auto-resets shall be attempted and operator intervention shall be required to restore the system to normal and to return the auto-reset function to its full enable state. Notification of all alarm conditions and reset attempts shall be provided to the central point at the maintenance work center.

Override timing and counter circuitry shall be provided to ensure that regardless of the status of the auto-reset function, the system shall not restore to normal if there are more than three alarms in any 15 minutes period.

9. **Fail-safe operation**

The design of the DME monitor shall be such that component failure, one at a time, or malfunction shall either result directly in an alarm condition, or shall not alter any alarm threshold level such as to allow an out-of-tolerance condition to occur without detection.

### 2.5 SYSTEM MONITORING AND CONTROL SUB-SYSTEM

The system Monitoring and Control (MAC) subsystem shall consist of a Remote Status Indication and Control Equipment (RICE), a Remote Status and Interlock Unit (RSIU), a Remote Maintenance Monitor (RMM), and remote control and monitor lines.

The following are the requirements for the system’s configuration and Functions. If the Contractor makes any deviation or exception to these requirements in order to employ new technology, or to combine the ILS and DVOR/DME MACs into an interrogated system, it shall be described in the Technical Proposal, in the same order as the following paragraphs and subparagraphs.

#### A. REMOTE STATUS INDICATION AND CONTROL EQUIPMENT (RICE)

1. **Remote Control Status Unit (RCSU)**

The RCSU shall provide remote control and monitoring of the DVOR/DME system.
a. Functional Capabilities

The RCSU shall process the following functional capabilities:

1) ON/OFF and RESET control of the DVOR/DME system.

2) Visual indication of the status, including monitor bypass, of the DVOR and DME system.
   - NORMAL/ON status indicators shall be green,
   - ALARM/OFF status indicators shall be red,
   - ABNORMAL status indicators shall be amber.

   Aural alarms shall be initiated for changes in the operational and/or environmental status of each subsystem.

3) The status data of the DVOR/DME shall be capable of outputting to the Remote Status and Interlock Unit (RSIU) at least as often as subsystem status data is received. The status data shall contain the following information:
   a) Current status and alarm information of the DVOR/DME
   b) The loss of a main transmitter at the DVOR/DME and the back-up transmitter is operating shall result in the RCSU and RSIU “Main” status indicators being extinguished and the “Standby” indicator being illuminated.
   c) Implement subsystem status indicator changes and aural alarms within one (1) second of a message announcing a change in facility status for any subsystem.
   d) The aural and silence volume control shall adjust the output amplitude continuously. The minimum amplitude shall be such that the alarm is discernible at a distance of 9.14m (30 feet) with no background noise.
   e) Send all subsystem status information to the RSIU.
   f) Provide the capability to check the status of all RSCU indicators
g) Visual and aural indication when AC power is lost.

h) Battery backup to ensure uninterrupted operation of the RCSU and RSIU for the loss of AC power. The loss of AC power shall not affect the functionality of RCSU, the RSIU, or any DVOR/DME subsystem.

2. Remote Status and Interlock Unit (RSIU)

a. Status and Control Capabilities

The RSIU, using control and status data input from the RCSU, shall possess the status and control capabilities specified below:

1) Provide status of the operating DVOR/DME electronic equipment.

2) Provide status change aural alarms, aural SILENCE and LAMP TEST controls.

3) Provide an aural alarm and volume control. The aural alarm shall be activated upon receipt of subsystem status change information, including FFM status from the RCSU. The alarm shall also be initiated each time the interlock switch is operated. The volume of the aural alarm shall be adjustable through the panel; the minimum volume shall be distinguishable from 9m (30 feet), the volume shall not be adjustable to completely be off.

4) Provide Indicator test control to verify the operability of the visual and aural alarm components.

b. RSIU panel

The RSIU assembly shall meet the following requirements:

1) Sufficient connectors to connect the RSIU to two separate RCSUs for interlock purpose. Mating connectors for each RSIU connector shall also be provided. Multiple connectors, if required, shall include labels or keying to preclude incorrect cable termination.

2) The RSIU installing at ATCT, the Contractor shall coordinate with the Contractor of ATC communication system.
B. REMOTE MAINTENANCE MONITOR (RMM)

The RMM shall be configured to be able to monitor remotely, record and verify the operating status of DVOR/DME system as well as the sensing data from all of the environmental sensors.

The Contractor shall describe a RMM subsystem that provides the following. The appropriate photos, pictures or diagrams shall be included.

- Configuration and related maintenance function.
- Functions to be monitored remotely (including environmental parameters)
- Functions to be monitored remotely
- Functional changes and events to be date/time stamped confirmed and stored.
- Stored events, status and parameter changes to be printable in various formats.

2.6 INSTALLATION AND MAINTENANCE MANUALS, TEST EQUIPMENT AND SPARE PARTS

A. INSTALLATION AND MAINTENANCE MANUALS

Five (5) complete sets of the manuals needed for installation, check-out, alignment, calibration, operation and maintenance of DVOR/DME system equipment shall be furnished with the system.

B. EQUIPMENT TESTING REQUIREMENTS

As a minimum, the test equipment and tools needed for installation, check-out, alignment, calibration, operation and maintenance of DVOR/DME system shall be furnished as follows:

1. All special to type tools.
2. One oscilloscope (except if installed in cabinet) and one multi-meter shall be provided per equipment.
3. One multi-meter shall be provided at the remote maintenance room (remote monitor room)
4. The proposal shall include a list of basic standard and special test equipment. Additional specific test equipment other than the items stated in subparagraph 1, 2 and 3 above shall also be presented as an optional separate item with the cost proposal.
C. SPARE PARTS

1. PCBs and Modules

For DVOR/DME system, the Contractor shall provide a list of PCBs and modules installed per equipment and failure rate per each item, in the technical proposal. The PCBs and modules used during the first three (3) years operation shall be provided.

2. Consumables

The consumables used during the first three (3) years operation shall be provided.

3. Supply after Acceptance

The Contractor shall provide spare parts free of charge if there is any discrepancy in line with installed quantity in the system.

2.7 PREPARATION FOR DELIVERY

A. PRESERVATION AND PACKING

Preservation and packing of items shall be in accordance with best commercial practice.

B. PACKING

Packing of items shall be in accordance with best commercial practice. No more than one of each item and associated hardware shall be packed in each shipping container.

C. MARKING

Each packing and or shipping container shall be durably and legibly marked with the following information:

1. Name of item
2. Serial number(s)
3. Quantity
4. Contract number
5. Gross weight of container
6. Manufacture’s name
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## DIVISION 3 : ATC COMMUNICATION SYSTEM

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PART 1 – DESCRIPTION

1.1 SCOPE

This System Requirements Specification (SRS) describes the requirements for Air Traffic Control (ATC) Communications system for providing the Air Traffic Service by the Air Traffic Control Tower (ATCT) at the Languindingan Airport.

The following systems are required for performing Air Traffic Service, the following systems such as Very High Frequency (VHF) radio equipment, High Frequency (HF) Radio Equipment a Small Tower Voice System (STVS), System Clock, AMHS/AFTN System and Voice Recording System. The system shall provide for air-ground communications between controllers, pilots and administrative personal at the airport.

1.2 REFERENCE

- THE RULES AND REGULATIONS OF THE REPUBLIC OF THE PHILIPPINES

- ICAO DOCUMENTS
  - ICAO Annex 10 Aeronautical Telecommunications;
  - ICAO Doc. 8071 Flight Testing Procedures

- FAA DOCUMENTS
  - FAA-STD-003 Paint Systems for Structures

- OTHER DOCUMENTS
  - RTCA DO-216 General Specification for Ground Based Electronic Equipment

1.3 ABBREVIATIONS

The abbreviation/acronyms are used in this specification:
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<thead>
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<th><strong>Abbreviations</strong></th>
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<tr>
<td>AC</td>
<td>Alternate Current</td>
</tr>
<tr>
<td>AFTN</td>
<td>Aeronautical Fixed Telecommunication Network</td>
</tr>
<tr>
<td>AG</td>
<td>Air-Ground</td>
</tr>
<tr>
<td>AGC</td>
<td>Automatic Gain Control</td>
</tr>
<tr>
<td>AGL</td>
<td>Above Ground Level</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude Modulation</td>
</tr>
<tr>
<td>AMHS/AFTN</td>
<td>Aeronautical Message Handling System (ATS Message Handling System)</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATCT</td>
<td>Air Traffic Control Tower</td>
</tr>
<tr>
<td>ATIS</td>
<td>Automatic Terminal Information Service</td>
</tr>
<tr>
<td>ATM</td>
<td>Air Traffic Management</td>
</tr>
<tr>
<td>ATMS</td>
<td>Air Traffic Management System</td>
</tr>
<tr>
<td>ATS</td>
<td>Air Traffic Service</td>
</tr>
<tr>
<td>AWOS</td>
<td>Automated Weather Observing System</td>
</tr>
<tr>
<td>BIT</td>
<td>Built In Test</td>
</tr>
<tr>
<td>BITE</td>
<td>Built In Test Equipment</td>
</tr>
<tr>
<td>CA</td>
<td>Common Answer</td>
</tr>
<tr>
<td>CAS</td>
<td>Commercially Available Software</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial-Off The Shelf</td>
</tr>
<tr>
<td>CR</td>
<td>Common Release</td>
</tr>
<tr>
<td>CTS</td>
<td>Code Time Source</td>
</tr>
<tr>
<td>DA</td>
<td>Direct Access</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DTMF</td>
<td>Dual Tone Multi Frequency</td>
</tr>
<tr>
<td>DT&amp;E</td>
<td>Development Test and Evaluation</td>
</tr>
<tr>
<td>Abbreviation</td>
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<tr>
<td>EIA</td>
<td>Electronics Industries Association</td>
</tr>
<tr>
<td>EMF</td>
<td>Electromagnetic Frequency</td>
</tr>
<tr>
<td>EVIS</td>
<td>Emergency Communication Voice System</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration, USA</td>
</tr>
<tr>
<td>FAC</td>
<td>Factory Acceptance Test</td>
</tr>
<tr>
<td>FIS</td>
<td>Flight Information Service</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphic User Interface</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>HZ</td>
<td>Hertz</td>
</tr>
<tr>
<td>IA</td>
<td>Indirect Access</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IF</td>
<td>Intermediate Frequency</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>KHz</td>
<td>Kilohertz</td>
</tr>
<tr>
<td>Km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>Kw</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LRU</td>
<td>Line Replaceable Unit</td>
</tr>
<tr>
<td>LS</td>
<td>Loudspeaker</td>
</tr>
<tr>
<td>MAC</td>
<td>Monitor And Control</td>
</tr>
<tr>
<td>MDF</td>
<td>Main Distribution Frame</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MIT</td>
<td>Maintenance Interactive Terminal</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
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<tr>
<td>MTTR</td>
<td>Mean Time To Repair</td>
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<tr>
<td>NDI</td>
<td>Non-Development Item</td>
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<tr>
<td>NOTAM</td>
<td>Notice To Airman</td>
</tr>
<tr>
<td>NTE</td>
<td>Not To Exceed</td>
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</table>
1.4 SYSTEM OVERVIEW AND PROPOSAL

A. SYSTEM OVERVIEW

The ATC Communication system for the Laguindingan Airport shall include VHF radio communications, STVS, Voice Recording System, System Clock, Automatic Terminal Information Service and the systems integrating other appendant equipment.

Ground-air communications shall be provided for air traffic control services on all surface movement areas on the airport and to the surface in the terminal area. All equipment shall be properly grounded, and the antennas shall have proper lightning protection devices to protect the equipment.

The STVS shall provide circuit switch, intercom, inter-phone and air/ground communications.

The Voice Recording System shall consist of a primary and backup system that records all operational positions and radios.

The ATC communication system shall synchronize its clock with the airport master clock, distribute its clock to slave clock (TX, RX, ATCT, Maintenance Consoles).

The equipment specified herein shall be commercial off-the-shelf/non-developmental (COTS/NDI) products which conform to the physical, functional, environmental and
other compliance requirements specified herein. This equipment will be remotely located and operated and shall include Built In Test Equipment (BITE) and remote monitoring and control interfaces and capabilities.

B. PROPOSAL FOR PRODUCTS TO BE FURNISHED

The proposal shall include the products name and description that meet or exceed the performance requirements specified herein. The physical configuration of the proposed subsystems may differ from the specification in this proposal, but the performance requirements shall be met. If the proposed configuration does differ from requirements described in this specification, the proposal shall contain technical data and the rational to provide sufficient information that all performance requirements are met or exceeded.

The Contractor shall submit the list of all the components including the quantity per item for the ATC communications system to be established for Laguindingan Airport with reference to Paragraph 1.5 below. The proposal shall include a list of all tools, test equipment, technical manuals, spare parts, and training plans required for the operation and site maintenance for the communication system to be installed. The proposal shall also include descriptions of manufacturing, testing, transportation, installation, check-out, system integration, and training support services that will be provided as well as any options that may be available to enhance the life cycle support for the installation and support of the proposed communication system.

The technical proposal shall be organized in the same order as this specification, and be accompanied with photos, appropriate as-built drawings and installation and operating manuals to aid the owner’s understanding of the technical contents of the proposal. When the proposed products have different characteristics (improvements) from what this specification requires, the proposal shall highlight the corresponding part of the proposal by underlined and bold type letters to aid owner in identifying changes during the evaluation.

If the Contractor fails to respond appropriately to this SRS, such as failure to provide photos, diagram or description of the performance requirements, etc., so that it is very hard for the owner to make a judgment, he will be deemed to have no intention to bid.

1.5 ITEMS AND QUANTITIES TO BE FURNISHED BY THE CONTRACTOR

The Contractor shall provide all the items necessary to establish and operate an ATC communication system. The table below is intended to provide references to the Contractor for developing his technical proposal.
<table>
<thead>
<tr>
<th>No</th>
<th>Items to be provided</th>
<th>Unit</th>
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<th>Remarks</th>
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<td>VHF Radio Communication Facilities</td>
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<tr>
<td></td>
<td>- VHF Transmitter (50W)</td>
<td>EA</td>
<td>8</td>
<td></td>
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<tr>
<td></td>
<td>- VHF Transmitter Antenna</td>
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<td>2 spars</td>
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<td>- VHF Receiver</td>
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<td>- VHF Receiver Antenna</td>
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<td>2 spars</td>
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<td>- VHF Multi-channel Transceivers (50W)</td>
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<td>- Standard Rack</td>
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<td>- HF Dipole Antenna (Broad band)</td>
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<td>- Automatic Antenna Tuner</td>
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<td>- Remote Control Unit</td>
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<td></td>
<td>- Standard Rack</td>
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<td>- Voice Control Equipment</td>
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<td>- DC Power Supply Unit</td>
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<td>- ATIS voice synthesis processor</td>
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<td>- ATIS ATC operation terminal</td>
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<td>ATCT cap</td>
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<td>- ATIS maintenance terminal</td>
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<td>- Approach Control Console</td>
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<td>- Flight Data Console</td>
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<tr>
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<td>- Aerodrome Control Console</td>
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<td></td>
</tr>
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<td></td>
<td>- Supervisor Console</td>
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</tr>
<tr>
<td>8</td>
<td>Flight Service Station</td>
<td>Lot</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Flight Service Console</td>
<td>Set</td>
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</tr>
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<td>Air Traffic Light Gun</td>
<td>EA</td>
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<td>Binocular</td>
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<td>12</td>
<td>R-F Cable and Connector</td>
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<td>13</td>
<td>Installation Kit</td>
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<td>16</td>
<td>Technical Manual</td>
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</table>
1.6 GENERAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION

The requirements specified in the following subparagraphs are extracted from RTCA DO-216 with some modifications to satisfy the needs of the owner, and shall be applicable to the entire ATC communications equipment unless otherwise indicated. For the items other than specified below, RTCA DO-216 shall be applied.

A. PHYSICAL DESIGN FOR EQUIPMENT

The equipment shall be designed in such a manner as to facilitate the accomplishment of the testing, adjustments and maintenance operations.

1. Equipment Cabinets

All the equipment shall be housed in a cabinet type rack. The cabinets shall include appropriate provisions for ventilation and a meter indicating operating status and operating hours of the equipment. Cabinet material shall be of rust-free or of an aluminum alloy. The thickness of the material and method of forming and reinforcing shall be such as to result in a rigid assembly capable of supporting all of the equipment while in a fully open condition without twisting or warping the cabinet. The cabinet shall be fastened to the bottom of the floor. When equipment cannot be mounted in cabinets, it shall be suitable for mounting in a standard 16 inch equipment rack.

2. Front panels

Front panels shall be of a uniform thickness with sufficient strength to support attached components and to withstand repeated openings without deformation.

3. Equipment unit construction

Major assemblies or units shall be designed to be completely removable from their enclosures without disassembly. Access shall be provided to modules or subassemblies from the basic equipment from the front or rear of the equipment or through the use of swing-out chassis, pull-out drawers with mounting slides or similar means.

4. Electronics protection

The ground tap shall be installed at the front of the equipment rack to protect the equipment from electrostatic whenever any card or module is removed or replaced by the maintenance personnel.
B. **ADJUSTMENTS**

All the equipment shall be designed such that all transmitter, monitor and control adjustments essential for proper operation and maintenance, and all indications resulting from operations shall be displayed for maintenance personnel as follows:

1. **Adjustment display**

   A portable terminal connected to the equipment or the screen of the maintenance console shall be capable of displaying all control settings on a neatly formatted screen or screens. For purposes of making adjustments, parameters must be selected by cursor, menu, or by typing in a name or code. For a system which requires 2 operators, input to make adjustments, on-screen help must be provided. The Contractor shall propose any device or feature that facilitates the adjustments, providing diagrams and/or description must be presented.

2. **Adjustment storage**

   Electronically entered control settings must be stored automatically in non-volatile memory for at least 90 days, either immediately upon entry or at the conclusion of an adjustment/maintenance operation.

C. **INTERIOR EQUIPMENT FINISHES**

   The surface of the cabinet and all control panels shall be coated with a base-primer and two top-coats of a semi-gloss baked on enamel. The coating shall be selected to withstand the environmental conditions specified in paragraph 1.6L2, and shall be the color specified by the Owner’s Representative.

D. **EXTERIOR EQUIPMENT FINISHES**

   The radio antenna towers and antenna supports that are installed at ATC transmitter site and ATC receiver site shall be painted in an obstruction marking configuration in accordance with Section 8.10, “Obstacle Markings of Standards for Aerodrome” - CAAP. Finishing paint shall be in accordance with FAA-STD-003, or equivalent industry standard, to withstand exposure to a marine environment with concentrated salt spray. The obstruction light(s) shall be installed atop radio antenna supports in accordance with Philippine Aviation Act.

E. **TEST POINTS, CONNECTORS & FAULT DIAGNOSTICS**

   Each line replaceable unit (LRU) of the ATC communications equipment shall contain test points and connectors appropriately labeled and numbered to provide for
the examination of essential voltages, signal amplitudes, wave forms and timing characteristics and to provide for the connection of test equipment for troubleshooting, adjustment and maintenance operations. Units employing micro-processors shall be provided with a diagnostic routine capable of locating the cause of any failure to the LRU or lower.

F. RESET SWITCH

Each equipment shall have a front panel mounted, momentary contact switch labeled “RESET”. This switch shall be designed to prevent any unintentional activation of the reset switch by the operator or maintenance personnel. Activation of the reset switch shall cause all program variables and all software/hardware controlled hardware to be initialized to a predefined condition from which normal program execution can continue.

G. TEST METER

A meter, meters or type of indicator shall be provided to allow convenient monitoring of functional parameters required for initial equipment tune-up, preventive and corrective maintenance.

H. LOCAL STATUS INDICATORS

Each equipment shall be provided, as a minimum, with indicator lamps to indicate operational status of major functional areas of the subsystem as follows.

1) Station normal (green)
2) Monitor alarm (red)
3) Monitor alarm by-pass (amber)

I. SPARE PARTS, TEST EQUIPMENT AND TOOLS

All spare parts, test equipment and tools required to operate and maintain the ATC communication equipment shall be provided in accordance with paragraph 2.7 of the SRS as a minimum. In addition, a convenient means of mounting or storing the tools or cables shall also be provided.

J. VOLTAGE REGULATORS

Voltage regulation in the equipment shall be provided (if required) by means of voltage or current regulators, or both, in the DC output circuit of the power supplied.
K. TRANSIENT PROTECTION

The equipment shall be protected against damage or operational impairment due to induced transients on any ungrounded AC power line, communication, control, signal or monitor line entering or leaving the subsystem or equipment shelter or ancillary unit. In addition, the proposal may include other specific state-of-art techniques incorporated into proposed products for protecting the equipment from external transients.

L. ENVIRONMENTAL SERVICE CONDITIONS

1) For equipment installed outdoors:

The environmental service conditions required for equipment installed outdoors (such as Antennas) shall be as follows:

a. Temperature : -20° - +70°C
b. Relative humidity : 5 - 100%
c. Wind : up to 161Km per hour (100MPH)

2) For equipment installed in an attended facility:

The environmental service conditions required for equipment installed in an attended equipment room or operation room shall be as follow:

a. Temperature : -20° - +55°C
b. Relative humidity : 10 - 95%

3) VCS :

a. Temperature : +5° - +40°C
b. Relative humidity : 10 - 95%

M. PRIMARY POWER

All equipment shall be designed to operate on 220 V AC, 60Hz, three (3) phase. And all equipment shall also be designed to interconnect with the proper Uninterruptible Power Supply (UPS), and shall be stated in the proposal.

N. STANDBY POWER

The ATC (HF and STVC) shall operate using a continuously charged DC battery power supply system which will support a continued, uninterrupted normal operation
in the event of a main power failure. The Contractor shall state his strategy for operating uninterrupted power for all systems ATC (HF and STVC). The Proposal shall contain the minimum running time using the proposed battery power source when mains supply is removed, including the critical battery discharge point for each facility type, the time required for self-restore capability to recharge flat batteries up to 100%, and where and how to install the battery packs.

The I ATC (HF and STVC) remote monitoring and control unit, and remote status, if separately powered, shall include a standby battery. The battery shall include an automatic recharge circuit and the battery shall provide at least two hours of operation upon failure of a primary power.

When primary power is restored, the state of the battery shall in no way cause harm to or affect the operation of the respective subsystems.

O. LIGHTNING SURGE PROTECTION

The internal and external lightning surge protection system to be provided by the Contractor must meet the best industry standards. The Contractor should also be required to submit analysis report on the coverage of the lightning surge protection system.

1.7 OBSERVANCE CONTRACTOR

This paragraph contains additional information on administrative and contractual terms and conditions as follows:

1) The contractor shall provide qualified engineers or technicians during the equipment adjustment, calibration, test, fault isolation, repair, ground support of flight test and data collection.

2) The contractor shall provide air transportation, lodging, local vehicle, international telephone fee, correspondence and subsistence requirements of the contractor's engineers or technicians.

3) The contractor shall be responsible for the safety of personal and shall be held responsible for accidents which may occur during the period of this project.

4) The contractor shall have the full responsibility for the adjustment, testing, alignment, recovery or replacement of loss and damage to all equipment.

5) The contractor shall consult the Owner in case of any contradiction or anything not mentioned in this specification.
A. ACCEPTANCE TEST

1. FACTORY ACCEPTANCE TEST (FAT)

It is the responsibility of the Contractor to conduct necessary test at the Contractor’s factory in the presence of the Owner’s representatives. These shall consist of visual inspections, operation tests, insulation resistance tests, withstand voltage test, earthing test, ratio tests, etc. in accordance with the manufacture’s standards.

The Contractor shall bear the cost of transportation of the Owner’s representatives and Consultant’s Air Navigation Specialist from/to their hotel, from/to Philippines by regular fare including local transportation from the hotel to the factory site. The Contractor shall also bear the cost for the hotel accommodation and food as well as daily expenses covered by payment of US Dollars 300 per diem by the Contractor to each person. Expenses to be incurred for the two (2) Owner’s representatives and one (1) Consultant’s Air Navigation Specialist spending ten (10) days of stay (inclusive of travel time) shall be included in the proposal.

2. SITE ACCEPTANCE TEST (SAT)

(1) The SAT procedure is a series of tests to be carried out by the contractor and witnessed by the Owner. These tests shall be performed to verify the optimum performance of the entire system in accordance with the requirements outlined in the technical specifications of this document and shall include precise tests and evaluations of installation status, performance and operation status.

(2) If any part of the site acceptance test is declared unsatisfactory by the Owner’s representative, acceptance will not be possible. When the amount of work comes up to the standard in accordance with the installation procedures, acceptance will be accomplished.

3. DATA PREPARATION FOR ACCEPTANCE TEST

The contractor shall prepare items to be checked and tested for the SAT and shall submit three (3) copies of the data to the Owner not later than two (2) weeks before the start date of the SAT. Data to be prepared shall include the following items:

(1) Site acceptance test time schedule.

(2) Check list and formats for the SAT.

(3) SAT procedures.
4. **CHECKLIST AND FORMATS FOR SAT**

The checklists and formats for the test shall include the following items:

1. Objective of each test.
2. Status of subsystem prior to each test.
3. Reference value or result to be expected of each test.
4. Actual test value or result during the SAT.
5. Any alignment or remedial action taken during the SAT.

5. **SAT PROCEDURES**

The acceptance test shall be executed in accordance with the procurement specification and contractor's proposal to include the following items:

1. Examine whether all the necessary equipment are perfectly installed.
2. Examine whether all the important system parameters and the related functions are tested.
3. Quantity inspection.
4. Flight check is completed.

**B. UNSATISFACTORY SAT**

1. Should any part of the site acceptance test be declared unsatisfactory by the Owner, the contractor shall replace the disqualified part or component by satisfactory one. The replacement shall be carried out until the completion date of the equipment installation.

2. In case that a replacement is exceeded completion date, the contractor shall compensate the Owner for all damages according to the related laws and ordinances.

3. The contractor shall submit a report to the Owner describing the exact cause and remedial action taken for the unsatisfactory test item.

1.8 **EDUCATION AND TRAINING**

The contractor shall be responsible for ATC communication education and training for Owner’s staffs for both contractor's factory training and on-site training (On-the-job training).
The contractor shall prepare necessary education materials and training aids. All training shall be conducted in the English language and the contractor shall submit the curriculum and training schedule at least, two (2) months before the training start date.

A. FACTORY TRAINING

(1) The contractor shall provide training for six (6) Owner’s staffs at the manufacturer's factory. The training course shall be designed to bring up the trainees to a sufficient level for the proper operation and maintenance of the proposed system. The training period of ATC communication shall be a minimum of two (2) weeks. The contractor shall provide the round-trip airfare, training fees, education materials, official trip expenses (Hotel fee, meals, daily allowances), etc. Official trip expenses shall be provided in accordance with the Guidelines of the Civil Service Commission of the Philippines.

The number of trainees and the duration of the training for the factory training course for ATC Communications project are required as noted on the following table.

<table>
<thead>
<tr>
<th>Training course</th>
<th>Weeks</th>
<th>Number of trainees</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHF Equipment</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>HF Equipment</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>STVS Equipment</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

(2) The training shall be planned to be complete within one (1) month before the start of equipment installation.

(3) The contractor shall be responsible for providing transportation facility during the training period on site.

B. ON THE JOB TRAINING

During the on-site shake down test period, the contractor shall provide on-the-job training for the theory of operation, preventive maintenance procedure, detailed alignment procedure and trouble-shooting techniques of the system. On-the-job training shall be conducted to improve the proficiency level of maintenance staff. Instruction for preventive and corrective maintenance procedures shall be conducted for each individual system with introductions to block diagram and schematic diagram analysis.

The number of trainees and training periods that the Owner required for the on-the-job training courses are as follows.
### C. REQUIREMENT OF FACTORY TRAINING COURSE

All training courses shall include separate chapters for theory and practice, hardware and software. After completion of the training, trainees shall be able to isolate and restore defective hardware modules or cards, and fully understand the architecture of hardware and analysis of operating system and application softwares.

### 1.9 DOCUMENTATIONS

The contractor shall provide technical manuals and related documents written in English language.

#### A. QUANTITIES OF REQUIRED DOCUMENTS

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Weeks</th>
<th>Number of Trainees</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATC Com.</td>
<td>4</td>
<td>at least 5</td>
<td></td>
</tr>
</tbody>
</table>

1. Installation plan and drawings : 3 copies
2. System inspection and test reports : 2 copies
3. Training plan : 1 copy
4. Training manual and materials : 1 set for each trainee
5. Technical manuals : 5 copies for each equipment. (English)

#### B. TECHNICAL MANUALS

The manuals shall contain the following chapters.

1. General and functional descriptions for each subsystem.
2. Equipment installation procedure and Theory of operation.
3. Preventive maintenance procedures and Corrective maintenance procedures.
4. Trouble-shooting procedures.
5. List of bench stock items with their types, part numbers, and quantities.
6. Parts illustrations and pictures.
7. Block diagrams and Detailed schematic diagrams.
1.10 COMMISSIONING FLIGHT TEST AND OPERATIONAL TEST RUN

Radio Navigational Aids shall be subject to Flight Test by the contractor. This test shall conform to those set out in the ICAO Manual Doc. 8071, Annex 10 and Annex 14. Engineer will make arrangement for the aircraft and personnel necessary for the flight test. The flight test shall be carried out by the contractor.

In the event of re-testing the flight to be conducted by the contractor’s engineer as a result of any such defects, the Contractor shall make available at the site his personnel to witness the initial flight test.

After the commissioning flight test, the Contractor shall perform the operational test run. The Contractor shall take immediate actions required to correct the operational and functional problems that occurred during the operational test run period. All the corrective actions shall be recorded and the records maintained. The recording files shall include the date and time the problem occurred, cause of failure(s) and a brief description of corrective action to be taken. This record shall be submitted to the Owner.

The cost of all personnel, equipment flight charge, etc., shall be deemed to be included in the Contract price.

1.11 WARRANTY

The contractor shall warrant that no system down or performance degradation will be encountered for three (3) years after the date of final acceptance. During the warranty period, the contractor shall provide materials and technical services without any cost to the Owner. However, the contractor shall be responsible for equipment problems caused by any design and production faults regardless of warranty period. When those problems occur, the contractor shall replace required parts of equipment without any cost or compensation.

PART 2 – PRODUCTS

2.1 VHF SYSTEM

A. GENERAL

This ATC communication system should be designed as multi-mode system and will be able to make transition to VDL without hardware replacement in the future. All systems shall be in dual or redundant configuration and the following requirements and characteristics shall be satisfied. Performance characteristics for VHF equipment are specified in the following paragraphs.
B. VHF SYSTEM PERFORMANCE CHARACTERISTICS

1) Un-manned System

Remotely controlled and monitored solid-state transmitters and receivers shall be proposed in unmanned stations for ground-to-air voice communications.

2) Transmitter Antennas

The feed lines of the antennas shall be helix cable to minimize the signal loss. The proper cable tray shall be used in order to install the antenna cables in order. The layout, allocation and installation of the antennas shall be implemented with the best possible solution under the local circumstances to minimize any adverse affect by the interference from each other. Any associated device shall be installed if required. The Contractor shall propose the antenna allocation and the configuration method.

3) Receiver Antennas

The layout, allocation and installation of the antennas shall be implemented with the best possible solution under the local circumstances to minimize any adverse affect by the interference from each other. Any associated device shall be installed if required. Contractor shall propose the antenna allocation and the configuration method.

4) Tuning

Multi-channel transceiver shall operate on single channel frequency and shall make use of a frequency synthesizer with the capability of automatic tuning over the entire range of 112 to 156 MHz without any change of elements such as antenna or coupling devices. Single-channel transmitters and receivers shall operate on a single fixed frequency. The initial frequency assignments will be provided to contractor after contract award.

5) Remote Control and Operations

All fixed installation transmitters and receivers shall be capable of being locally and remotely controlled and operated. The remote control capabilities proposed should provide the same functionality as that which is available from the equipment front panel.

6) Equipment Switches and Indicators

On the front panel of the transmitter and receiver equipment there shall be a display and control switch capability to indicate and perform the following as a minimum.
a) Power On  
b) Equipment Transmitting or Receiving  
c) Frequency  
d) All AC/DC voltages and RF levels necessary for fault location  
e) Remote or local control  
f) Output power or received signal level  
g) Modulation depth  
h) VSWR  
i) BITE (self-test)  

7) Built-In-Test Equipment (BITE) and Monitor and Control (MAC)  

A) Monitoring and Control of the equipment  

Each radio system element shall have continuous on line performance monitoring by built in test equipment (BITE) down to Line Replaceable Unit (LRU) level. The BITE shall be controlled either locally or remotely by the MAC system, thereby enabling unattended operation. Based on results of its continuous monitoring BITE shall perform either automatically or on command from MAC, the following functions as a minimum:  

a. automatic switching between operational and standby units in case of failure and/or alarm for deviations outside specified limits of any major equipment parameter. This switching shall take place in 100msec or less from the time of fault recognition or command initiation from the front panel or MAC.  
b. Identification of the malfunctioning unit  
c. Assistance in troubleshooting  
d. Status monitoring and notification to MAC of failures/alarms of equipment  
e. The BITE system itself shall be monitored by a software test (watchdog). In addition to the BITE and/or MAC displays, a direct indication of the nature of the trouble shall be provided locally on the front panel of the equipment.  

B) Remote Monitoring and Control via Software  

The radios and all their associated subsystems shall be remotely monitored by remote control device and computer system simultaneously. The interface to/from computer system shall be via
RJ45 or equivalent. The Contractor shall state interface requirements with the Main Distribution Frame (MDF) or required IP infrastructure.

a) Local Monitoring and Control

The equipment shall be provided with the access for local maintenance, troubleshooting, and certification activities utilizing the internal BITE sensors, software, and monitor and control capabilities.

b) Remote Maintenance Requirements

The monitoring and control interface shall provide the capability to reconfigure the system, switch between redundant equipment, run diagnostic tests, and transfer control switch. This remote monitor and control interface capability shall be appropriate for remote monitoring and supervision purposes, remote operation and control purposes, and remote maintenance, troubleshooting, and certification based on commands from MAC from VHF and HF system.

c) Functions to be monitored

In accordance with the requirements specified herein, the Contractor shall describe in his proposal the functions to be remotely monitored.

d) Functions to be controlled

In accordance with the requirements specified herein, the Contractor shall describe in his proposal the functions to be controlled remotely by MAC and locally at the equipment. The minimum functions to be controlled from remote positions are:

a. Can be put into and out of standby mode Remotely
b. PTT
c. Automatic tuning and selection of preset frequencies

e) Qualification of International standard

The system shall qualify the following standard:

- ETSI
  - EN300676 (AM 8.33 and 25 kHz – established on June 2000)
  - EN301467 (EMC a AM and D8PSK vector
- VDL2

- EUROCAE
  - ED92 (VDL MOPS for airborne – established on March 2000)

- RTCA
  - MOPS VDL3 – SC172/WG3 Draft, Physical layer based on VDL2 MOPS
  - DO224a (MASPS) – SC172/WG2

- ICAO
  - Annex 10

8) Output Interface to Voice Logging System

The VHF System shall be compatible for integration to a Voice Logging System. An interface shall be available for the transceiver.

C. ELECTROMAGNETIC RADIATION

The systems shall be compatible with other systems and shall not degrade the performance of other systems located in close proximity: they shall not emit any radiation harmful to the users. Specified systems shall not adversely affect and degrade their own performance.

a. Protective Devices

Special protective circuits shall be built-in to ensure that any failure in the equipment does not cause further damage to other parts or components.

b. Performance and Operating Requirements

The equipment specified herein shall be in accordance with ICAO Annex 10 regarding safety, failsafe, emergency, and standby performance and operating requirements.

D. USE OF MULTI-COUPLER

Transmitter and receiver shall be compatible with a multi-coupler, and both transmitter and receiver shall not have any technical problem to be installed in one site.
E. VHF AM DATA Radio Characteristics

A) VHF AM Transmitter

a) Frequency Range : 118 – 136.975 MHz  
(wide band optional 116 – 136.975 MHz)
b) Emissions : Analog Voice - A3E Data  
- VDL Mode A (ACARS)  
- VDL Mode 3: D8PSK  
- VDL VDL Mode 2: D8PSK 31.5kbits/s  
- CSMA
c) Channel Spacing : Analog Voice - 8.33 kHz and  
25 KHz channel spacing
d) Dimension : 19 inch rack mount
e) Weight : 14 kg approx.
f) Transmitter Type : micro processor control
g) Warm-up : less than 30 seconds
h) RF output power : 50 watt (adjustable 10 to 50 watt)
i) RF output impedance : 50 ohm
j) Frequency Stability : less than 1 ppm
k) Preset Memory
   Function : up to 99 channels via control panel
l) Line Input Impedance : 600 ohms
m) AF Output Impedance : 600 ohms
n) Modulation Depth : adjustable up to 85% (adjustable)
o) Distortion : less than 3%
p) VSWR : less than 2:1 without power reduction
q) Operating Temperature: - 20 to + 55 degree in C
r) Operating Humidity : up to 95% at 40 degree in C
s) Altitude : 0 to 15000 feet

t) Power Supply : 22-31 VDC, 120/240VAC ±10%, 47-65 Hz

B) VHF AM Receiver

a) Frequency Range : 118 – 136.975 MHz (wide band optional 116 – 136.975 MHz)
b) Emissions : Analog Voice - A3E

Data - VDL Mode A (ACARS)

- VDL Mode 2: D8PSK 31.5kbits/s – CSMA
- VDL Mode 3: D8PSK 31.5kbits/s – TDMA
- VDL Mode 4: GFSK 19.2kbits/s - STDMA
c) Channel Spacing : Analog Voice - 8.33 kHz and 25 kHz VDL – 25 kHz
d) Dimension : 19 inch rack
e) Weight : 4 kg
f) Control Type : micro processor control

Sensitivity

- A3E (voice): less than -107 dBm for a 10dB (S+N)/N ratio with m= 0.3 at 1kHz (CCITT)
- D8PSK: -103 dBm (BER <10-3 without Forward Error Correction)

h) IF Selectivity

- 25 kHz channel spacing:
  -6 dB at ± 11 kHz
  -80 dB at ± 25 kHz
- 8.33 kHz channel spacing
  -6 dB at ± 3.5 kHz
  -70 dB at ± 8.33 kHz

i) Frequency Stability : less than 1 ppm

j) AGC characteristics : within 3 dB (-107 dBm to + 10 dBm)
k) **Squelch**: 1 to 15 dB, adjustable

l) **Preset Memory Function**: up to 99 channels via control panel

m) **Audio line output**: 600 ohms, adjustable from 0 to 100mW

n) **Operating Temperature**: -20 to +55 degree in C

o) **Power Supply**: 22-31 VDC, 120/240VAC ±10%, 47-65 Hz

C) **VHF Multi-Transceiver Characteristics**

a) **Frequency Range**: 118 – 136.975 MHz
   (wide band optional 116 – 136.975 MHz)

b) **Emissions**: Analog Voice - A3E
   Data - VDL Mode A (ACARS)
   VDL Mode 2: D8PSK 31.5kbits/s
   – CSMA VDL Mode 3: D8PSK 31.5kbits/s – TDMA
   VDL Mode 4: GFSK 19.2kbits/s - STDMA

c) **Channel Spacing**: Analog Voice - 8.33 kHz and 25 kHz VDL – 25 kHz

d) **Power Supply**: 22-31 VDC, 120/240VAC ±10%, 47-65 Hz

e) **Storage Battery**: DC Power Supply (including a rectifier)

f) **Operating Temperature**: -20 to +55 degree in C

g) **Preset Memory Function**: up to 99 channels

h) **Transmitter RF Characteristics**
   1) **Carrier Output Power**: 50W
   2) **VSWR**: 2:1
   3) **Spurious Output**: less than –80 dB
   4) **Frequency Stability**: less than 1 ppm
   5) **RF Output Impedance**: 50 ohms
   6) **Frequency Oscillation**: synthesizer

i) **Receiver RF Characteristics**
   1) **Sensitivity**: -101 dBm
   2) **Spurious Intensity**: less than –80 dB
3) Audio Response : 300 – 3400 Hz
4) Squelch : on/off switchable, lead adjustable

D) Cavity Filter Characteristics

a) Frequency Range : 118 to 136.975 MHz
b) Qo : more than 9,000
c) Insertion Loss : less than 1.3 dB
d) Impedance : 50 ohms
e) VSWR : less than 1.2:1
f) Operating Temperature : -10 to +55 degree C
g) Power Rating : 100 watt

E) Isolator Characteristics

a) Frequency Range : 118 to 136.975 MHz
b) Insertion Loss : less than 0.7 dB
c) VSWR : less than 1.3:1
d) Temperature Range : -10 to +55 degree C
e) Power Rating : 50 watts
f) Reject Isolation : more than 40 dB

F) VHF Antenna Characteristics

a) Frequency Range : 118 – 156 MHz
b) Impedance : 50 ohm asymmetric
c) Max Power : 600 watts with 7/16 connector
               250 watts with N type connector (optional)
d) Gain : 2 dBi Ref. to isotropic radiator
e) Horizontal radiation pattern : Omni-directional: deviation from circularity + 0.2 dB
f) Polarization : Vertical
g) Lightning protection : All metal parts DC grounded
h) Dipole structure : Type 7/16 connector for 600 watts
power Coax N type connector for 250 watts (optional)

i) Mounting : Three holes circular flange
j) Installation : On circular flange (with 1 ¼ rod optional)
k) Overall dimensions : Max dia: 114mm – length: 1300mm
l) Weight : 8 Kg
m) Max wind velocity : 200 Km/h
n) Thermal operational range : -30 to +70 degree in C
o) Humidity : up to 100%

2.2 HF TRANSCEIVER

A. GENERAL REQUIREMENT

1. The equipment shall be fully solid state and composed of module and Printed Circuit Board.

2. The system shall compose the following:
   a) HF SSB Transceiver : 2 sets (ATC equipment room)
   b) Remote Control Unit : 2 set (FSS and ATCT)
   c) HF antenna : 1 set (HF antenna farm)

3. Dual transceiver shall be contained in a 19 inches cabinet to operate as main/standby equipment together with other necessary equipment.

4. The transceiver shall be designed to be local/remote controlled and all necessary interface equipment shall be supplied and installed.

5. Remote Control unit shall be provided with the following function:
   a) Main/Standby selection
   b) Local/remote selection
   c) Frequency channel selection
   d) Selection frequency display
e) Frequency clarifier control
f) AF Gain control
g) Receiver signal

6. Output Interface to Voice Logging System

The HF Transceiver shall be designed to be compatible for integration to a Voice Logging System. An interface shall be available for the transceiver.

B. PERFORMANCE REQUIREMENT

1. General
   a) Frequency Range : 1.6 to 30 MHz
   b) Frequency increments : 1 Hz
   c) Number of preset channel : 100 user stations programmable spot frequency channel
   d) Type of Emission : CW, SSB (USB, LSB), AME, FSK (AFSK)
   e) Frequency setting : Synthesizer controller
   f) Frequency stability : ± 10 Hz
   g) Power supply voltage : Single phase 220V AC 60 Hz and 12-13.8 VDC
   h) Circuitry : All solid state/synthesized
   i) Operating frequency : Pre-selected channels
   j) Operating system : Press-to-talk (local/remote)

2. Transmitter
   a) RF output : 100W
   b) Output Impedance : 50 ohms
   c) Spurious suppression : Minus 50 dB or less
   d) Inter modulation distortion : 32 dB below PEP
   e) Carrier suppression : Less than minus 50 dB refer to PEP
f) Line input level adjustment : Minus 20 dB to plus 10 dB continuously

g) Frequency response : Within 3 dB from 300Hz to 3 kHz

h) SWR : Not to exceed 1.5:1

i) Microphone impedance : 600 ohms (dynamic)

j) Tone signal : 1,000-1,500 Hz

k) Frequency stability : Within 50 Hz

l) Type of Emission : J3E

3. Receiver

a) Sensitivity : 0.5 microvolt or less at 10 dB S + N/N for 5 miliwatts output (J3E/J7B/F1B)

b) Selectivity : 3 kHz band 2.4 to 3kHz at minus 6 dB ban Width 4.1 kHz or less minus 60 dB band width

c) Receiver type : Double superheterodyne

d) Spurious response : 70 dB or more

e) AGC characteristic : Less than 10 dB of output variation for 3 to micro-volts 100 microvolts by antenna input charge

f) Monitor output : More than 500 miliwatts

g) Line output : 0 dB at 600 dB

4. HF Antenna

a) Type : Broadband

b) Omni directional dipole

c) Dipole length : Less than 35m

d) Frequency range : 1.6 to 30 MHz

e) Polarization : Horizontal
5. HF Antenna Tuner

a) Frequency range: 1.6 to 30 MHz

b) Number of preset channels: 100 channels or more

c) Input power: Less than 200W PEP

d) Matching time: Less than 10 seconds for initial tuning less than 50 msec for preset channel

2.3 SMALL TOWER VOICE COMMUNICATION (STVC)

A. PRIMARY FUNCTIONAL REQUIREMENTS

The major functions of the STVC shall provide radio channel, telephone, intercom, etc., to the operator positions for all the communications related operations.

a. Intercom Function

The intercom function shall provide intercommunication call capability between local positions. The type and number of call termination available to each position shall be selected by software during position configuration.

1) Visual Alert Intercom Call - This type of call shall be a visual alert call termination in which the calling position selects the called position by direct access or indirect access and the called position is alerted visually that incoming call is waiting to be answered by the blinking of a direct access button or common answer button.

2) Override Intercom Call - This type of call shall be an override call termination in which the calling position selects the called position by a special direct access intercom selector and no action on the part of the called position is required to answer the call.

3) Manual Ring - The required function key shall be provided to send a call signal upon a DA key selection, for using the Ring Dial (RD) method.

b. Interphone Function

The STVC shall provide communications call capability to positions located external to the STVC system. The type and number of termination available at the position shall be selected during position configuration.

The STVC shall be able to interface with the following landlines and call
signals and shall have 50% expandability;

- Dual Tone Multi-Frequency (DTMF)
- 2 wire Ring Dial (RD) : at least 10 lines
- 4 wire Tone Dial (TD) : at least 10 lines
- 4 wire E&M : at least 3 lines

Universal trunk circuits associated with line conditioning equipment shall be furnished to provide various combinations of signaling, selective and non-selective outgoing and incoming call options. The proposal shall describe the technique and characteristics employed for the proposed products for the following types of calls.

1) Non-Selective Outgoing Call
2) Non-Selective Incoming Call
3) Selective Outgoing Call
4) Selective Incoming Call
5) Remote Override Outgoing Call
6) Remote Override Incoming Call

c. Mobile Air/Ground Radio

An air/ground radio subsystem shall be provided for communications between selected positions on the system and aircraft via VHF and HF using Remote Transmitter and Receiver sites.

d. Push-to-Talk Operation

The communications system shall be capable of operation with and without push-to-talk (PTT). Radio operation for aircraft shall always require PTT operation for transmission.

e. Operations Support PABX Subsystem

This subsystem shall be provided for operational, administrative, and maintenance personnel associated with the facility and the ground vehicle control facility. This subsystem shall be wired at least 20 end telephone instruments and 20 exchange trunks.

f. This system shall be compatible with the existing telephone service provider in the area.
B. EXTERNAL INTERFACES

The STVC system shall contain all equipment required per line to interface the STVC switching with external switching systems and equipment over external transmission facilities provided by the Owner.

1. Radio Trunk Switch

The Radio Trunk Switch shall be microprocessor controlled and interface the STVC switching network with 600 ohm, 4 wire voice radio circuits. It shall provide three sets of contact outputs for PTT actuation, transmitter main/standby selection, and receiver main/standby selection.

2. Universal Interphone Trunk Interface

The universal trunk interface shall be under microprocessor control and interface the STVC switching network with 600 ohm, 4 wire voice circuits with E and M lead supervision. Signaling battery shall not be provided by the universal trunk.

3. Signal Frequency Signaling Interface

The signal frequency signaling interface shall be provided where it is necessary to convert universal trunk signaling.

4. E and M Signaling Interface

E and M signaling interface shall be provided where signal battery must be provided or where additional sensitivity is required to operate the E and M lead supervision.

5. DTMF Signaling Interface

DTMF signaling interfaces shall be provided where it is necessary to convert the universal trunk signaling to DTMF signaling.

6. 20 Hz Signaling Interface

A 20 Hz signaling interface shall be provided where it is necessary to convert the 4 wire output of the universal trunk signaling to 20 Hz ringing.

7. Loop Signaling Interface

A loop signaling interface shall be provided where it is necessary to convert
the 4 wire output of the universal trunk 2 wire operation using loop supervision and loop dialing.

C. OPERATIONAL REQUIREMENTS

The STVC shall be designed to satisfy the following operational requirements:

1. **Intercom Function**
   
The intercom function shall provide call capability between local positions.

2. **Interphone Function**
   
The system shall provide call capability to position located external to the system.

3. **Air/ground radio function**
   
   An air/ground radio subsystem shall be provided for communications between selected positions and aircraft via VHF/HF radio at remote transmitter/receiver sites.

4. **Push-to-talk operation**
   
The system shall be capable of operation with or without enabling a push-to-talk (PTT) feature. When the push-to-talk feature is in “push”, the position’s microphone is enabled. When it is released, the position’s microphone is active for use with direct access. Air/ground radio operation will require PTT operation for each transmission.

5. **Direct access feature**
   
The direct access feature shall accommodate signal push button direct access.

6. **Indirect access feature**
   
The indirect access feature shall enable the operator to initiate an intercom or interphone call by means of a standard telephone key.

7. **Radio transmitter selection**
   
   A set of radio channels are assigned to each class marked operating position. Selection of the radio transmitter for each individual radio channel shall be by a transmitter selection key.

8. **Radio receiver selection**
   
The receiver for each radio channel assigned shall be selected by a receiver
9. **Class marks**

Programmable classification markings (class marks) shall be established at positions which grant trunk access such that any position can be restricted to set up calls to specific trunks or dial specific numbers on a trunk.

10. **Call transfer**

Any position shall be capable of selectively transferring incoming intercom and interphone calls to another position for answering.

11. **Position reconfiguration**

Intercom and interphone direct access key assignments, radio channel assignments, and position class marks shall be reconfigured from one position to another in accordance with system programmable configuration maps.

12. **Voice recording**

Main and standby voice recording of radio communications will be accomplished on a per channel basis. The communication at the position shall be recorded on a separate channel for recording on a voice recorder.

13. **Administrative users**

A telephone capability will be provided for operational, administrative, and maintenance personnel.

14. **Common answering feature**

Incoming calls which are not provided with direct access termination shall be automatically routed to the common answering feature.

D. **HARDWARE DESIGN AND CONSTRUCTION**

1. **General Requirements**

All hardware shall be constructed in accordance with RTCA DO-216 or good commercial practice for airport equipment. The STVC shall be modular to the extent that failed components are easily replaceable modules with the modularization based on the LRU definitions.

The structural strength and rigidity of the equipment units shall be such that common carrier handling in loading, shipping, unloading, and setting into position for installation shall not cause damage or deformation to any STVC component nor deformation to the equipment units.
The cabinets and frames for the STVC shall be designed for an average weight distribution of floor loading not to exceed 610 Kg/sqm (125 lb/ft²).

2. Safety

The STVC equipment shall be designed and constructed so that the potential for personal injury during installation, operation, maintenance or repair of any system components is minimized.

3. System Security

The contractor provided system equipment intended for ground level installation shall be provided with a suitable locking mechanism.

4. Electromagnetic Compatibility

The STVC shall not interfere with other systems when it is installed and shall operate compatibility in its installed environment.

5. Lighting Protection

Protective devices shall be provided as necessary to prevent damage to the equipment from surges on either the AC power lines, or the remote lines. The protective devices shall be capable of limiting initial spikes, as might result from nearby lighting strikes, to a value that will not damage any equipment. The protective devices shall be capable of withstanding repeated surges without damage or change in operating characteristics.

E. OPERATIONAL SOFTWARE

The contractor shall provide the operational software needed for STVC function in accordance with this specification. The system shall use a standard, unmodified graphical user interface (GUI), multi-tasking, COTS operating system. The use of commercially available software (CAS) also known as COTS is mandatory. All source programs used in the system shall be furnished to the Owner with classifying into appropriate groups at the time of contract turn-over. The required training for the maintenance personnel to operate the software shall be conducted accordingly.

F. QUALITY ASSURANCE REQUIREMENTS

The STVC equipment shall be designed in modular elements for quick, easy replacement in the event of failure. Maintenance functions and features shall be integrated in a modular manner to minimize the time required for fault detection, fault isolation, testing, repair and service restoration by making maximum use of current automation techniques and centralized maintenance control. The fault isolation shall detect a failed component to the LRU level with an accuracy of 100 percent.
In no case shall the maximum time to repair exceed 15 minutes.

2.4 AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

A. GENERAL REQUIREMENTS

1. ATIS shall be serving within a designated frequency in the VHF band, and shall be installed for twenty-four (24) hours broadcasting of information such as the current status of runways, meteorological information, aviation information and NOTAM which are classified into departure and arrival messages to the aircraft departing and arriving at Laguindingan Airport.

The broadcast shall be continuous and repeated. In the case that the airfield is designed for international air traffic work, the language used for the broadcast shall be English. If possible, the length of broadcast shall be adjusted for thirty (30) seconds to comply with the international standard. Any disturbance caused by the transmitting speed and the signals used for the ATIS transmission shall be avoided for understanding the contents of the broadcasting.

The equipment mentioned in the SRS shall be Commercial-Off-The-Shelf and Non-Developmental Items (COTS/NDI), which meet all of the physical, functional, environmental and other requirements defined in the SRS. The equipment shall be remotely installed and operated. The ATIS shall be capable of accommodating Built-In-Test-Equipment (BITE) and support the remote monitoring and control function. It shall be capable of interfacing with other communications networks.

2. The Contractor shall provide entire products necessary to construct and operate the ATC Communications System and present the lists of products to be installed by site.

The Contractor of the ATC Communications System shall supply and install the maintenance consoles for the Transmitting and Receiving Stations, ATC.

The tables regarding the products to be supplied as shown below are presented for reference when drafting a proposal. The Contractor shall elaborate on all products to be supplied, their quantities, model names and manufacturers in the proposal. If there are products which should be supplied for operation, but omitted from the list by mistake, such products shall be offered later at no cost to the Owner.
### Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Q'ty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ATIS voice synthesis controller</td>
<td>1 lot</td>
<td>• Equipment room (main/standby)</td>
</tr>
<tr>
<td>2. ATIS voice synthesis processor</td>
<td>1 lot</td>
<td>• Equipment room (main/standby)</td>
</tr>
<tr>
<td>3. ATIS ATC operation terminal</td>
<td>1 lot</td>
<td>• ATCT cap: 1Lot</td>
</tr>
<tr>
<td>4. ATIS maintenance terminal</td>
<td>1 lot</td>
<td>• Equipment room 1 Lot</td>
</tr>
<tr>
<td>5. Software</td>
<td>1 lot</td>
<td></td>
</tr>
<tr>
<td>6. Transmission and Network system</td>
<td>1 lot</td>
<td></td>
</tr>
<tr>
<td>7. Power, Lightning and Grounding</td>
<td>1 lot</td>
<td></td>
</tr>
<tr>
<td>8. Manual( Operation and maintenance)</td>
<td>1 lot</td>
<td></td>
</tr>
<tr>
<td>9. Auxiliary Systems</td>
<td>1 lot</td>
<td>• Standard rack</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Printer (2EA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Others</td>
</tr>
</tbody>
</table>

### B. SYSTEM CHARACTERISTICS

1. **AUTOMATIC TERMINAL INFORMATION SERVICE [ATIS]**

Automatic Terminal Information Service (ATIS) is a broadcasting system providing information on runway and approach in use, status of runway, weather and flight information, and NOTAM to arriving and departing aircraft for 24 hours in a day.

2. **OPERATIONAL CONCEPT**

   a) **OPERATION OF ARRIVAL AND DEPARTURE**

   ATIS shall be provided at the time in accordance with ICAO, with necessary arrival and departure information to aircrafts on or around Laguindingan Airport.

   b) **DESCRIPTION OF INFORMATION**

   ATIS shall broadcast up-to-date weather information, status of runway, status of navigation facilities and other information as well as any dangerous article and obstacle of maneuvering and approach area.
c) BROADCASTING VOICE INPUT

The voice file recorded and edited shall be played and transmitted by the computer program. Under special circumstances, which are not included in voice input data, manual operation shall be provided for the voice recording.

d) VOICE COMPOSITION CONTROLLER

The voice composition controller shall convert the information input by ATC center to voice signal on the computer with voice files stored in computer.

e) NON INTERUPTION OPERATION

ATIS shall be of duplex type consisting of main and standby system. All arriving and departing aircraft shall be informed by ATIS and, if required, the operator shall be able to adjust the interval. The continuous conversion of primary and standby shall be provided.

f) CONSTITUTION

The voice composition controller and processor shall be of duplex type consisting of main and standby system on arrival and departure. The operator’s terminal shall be established to operate redundant terminal programming to control by a data terminal without any interruption.

g) ATIS MESSAGES

ATIS messages shall meet ICAO regulation and contain the items stated below.

- ATIS FOR DEPARTING AIRCRAFT

  - name of aerodrome;
  - departure and arrival indicator;
  - designator;
  - time of observation, if needed;
  - main runway(s); status of system constituting a potential hazard, if any;
  - significant runway surface conditions and, if appropriate, braking action;
  - departure and holding delay, if appropriate;
• transition level, if applicable;
• other essential operational information;
• visibility and, when applicable, RVR;
• present weather;
• air temperature;
• dew point temperature;
• altimeter setting(s);
• any available information on significant meteorological phenomena in the approach and arrival including wind shear, and information on recent weather of operational significance;
• trend forecast, when available; and
• specific ATIS instructions.

h) INTERFACE WITH STVC

Voice information shall be interfaced with STVC and broadcast by VHF transmitter without any problem.

i) INTERFACE

ATIS shall be installed in consideration of the following for interface with other systems. The Contractor shall make out ICD needed for the connection with the external system Contractor and shall cover all expenses for this and get advance approval from DOTC. The Contractor shall develop and install the programs by taking procedures. Then input the data and conduct a test. If any problem arises after the completed installation, the Contractor shall clear the problem without charge to the Owner. The result shall be reported to DOTC.

- INTERFACE WITH WEATHER FACILITIES (AWOS).

j) TIME SYNCHRONIZATION

The ATIS system shall be synchronized with the airport master clock and the Contractor shall provide software, hardware, and run the cable for time synchronization. In case of no synchronized signal from the master clock, ATIS shall be operated with its own time.
k) REDUNDANT COMPOSITION

The ATIS system shall be designed with arrival and departure separately with redundant capability.

l) HARDWARE CHARACTERISTICS

The computers and auxiliary equipment for Voice Process Device and Voice Composition Processor of ATIS shall be the best grade workstations of general purpose computer. The Contractor shall install and equipment in accordance with the Owner’s requirements.

The ATIS requires minimum computer specifications as follows:

- Top grade workstation
- Color LCD monitor 21” or more.
- Audio card, speaker, and jack for microphone and headset.
- Printer (continuous paperwork)
- Facilities for connecting with transmitter and MDF

2.5 AMHS/AFTN SYSTEM

Manila center is operated on an AMHS/AFTN system, provided by COMSOFT. The AMHS/AFTN system in the Laguindingan Airport should be interfaced with the Manila center. This system should be fully compliant to ICAO and comprises the international AMHS and AFTN switch. The proposal shall also include system configuration for interface with the Manila center. Type of link to be used for the AMHS / AFTN system should be similar to the existing Cagayan de Oro Airport.

2.6 VOICE RECORDING AND PLAYBACK (Digital Type : Voice Recording System)

A. GENERAL REQUIREMENTS

1. All operational voice communication shall be recorded and each operating position will have a non-programmable audio output to the voice recording equipment. The voice recording of radio communications will be accomplished on a per channel basis and intercom/interphone communications on a per position basis.

2. The combined incoming and outgoing voice of intercom/interphone communication at the position shall be recorded on a separate channel for recording on a voice recorder. Radio and intercom/interphone shall not be recorded at the same time in the same channel.

3. A clock system shall be provided for time correlation of events.
4. The voice recording and playback systems shall be provided and installed in the ATC equipment room for recording the Laguindingan ATCT operations.

5. Each voice recording system shall consist of dual deck (deck 1, deck 2) and consist of the following hardware:
   a. The operator processor module
   b. Multi-channel recording system with automatic switch over, monitor channel, voice amplifiers, and redundant power supplies; and
   c. Time signal processing module in the multi-channel recording system

B. SYSTEM CHARACTERISTICS

The followings are characteristics of the system in Voice Recording feature:

1. The number of channels to be recorded shall be 20 channels as a minimum to meet the following requirements.

2. The data from each radio channel and each position shall be recorded on two different recording channels at a time to be recorded as a double.

3. The recording system shall consist of a primary system plus a backup as dual deck (deck 1, deck 2). The backup system shall be in hot standby while the primary system is working or vice versa.

4. The recorded information shall be retained for a period of at least three months on removable media. The cabinet for the safe-keeping of the recorded media shall be provided.

C. PLAYBACK CAPABILITY

An off-line playback capability shall also be provided in a separate area for legal purposes and to reconstruct events.

D. TIME MARKING

The system shall provide time marking or stamping from the system clock to provide correlation with operational data and to reconstruct events.

E. CHARACTERISTICS

The following are technical characteristics of the system:

1. Security access;
2. Greater than 24.5 hours recording time on a signal media;
3. Multiple concurrent accessing, recording and playback of the same or different stored segments;
4. Playback of up to five simultaneous channels;
5. Real time monitoring of any channel by designated users;
6. Monitoring and control;
7. Separate bulk erase capability;
8. Recording start time shall be less than 100ms;
9. Input impedance 600 ohms;
10. Input levels from –35 dBm to 0 dBm;
11. Cross talk shall be less than 40 dB;
12. Frequency response of each channel from 300 Hz to 3000 Hz less than or equal to 4 dB.
13. Harmonic distortion of less than or equal to –34 dBm; and
14. Capable of connection to analog lines, CEPT-1, ISDN
15. Voice recording system shall be digital type
16. Remotely monitor the operating status of the recorder
17. Have the internal battery for uninterruptible operation in the event of primary power failure.

2.7 COMMUNICATION CONTROL EQUIPMENT

As a requirement for the control console component each ATC control console shall accommodate respective component as follows:

1. Radio control panel (8 channels)
2. Intercom control panel (24 channels including direct speech)
3. Speaker panel (with volume control)
4. Digital clock (hour, minute and second) (Time announcing circuit)
5. Voice control panel
6. Jack box (for hand-microphone gooseneck microphone and headset)
7. Foot switch jack panel and gooseneck microphone
8. Branch display
9. Console light
10. Headset with microphone (to be supplied accessory)
11. Headset (for intercom control panel)
12. Strip board holder (Removable)
13. VHF Tx & Rx main/standby control panel
14. Alarm push button panel (handset and alarm push button)
15. Clearance control indicator
16. Chair
17. Others

2.8 AIR TRAFFIC LIGHT GUN

A. GENERAL DESCRIPTION
   1. Air Traffic Light Gun (ATLG) shall be installed in aerodrome control tower.
   2. ATLG is to be used for the purpose of providing light signals from the control tower to aircraft for the safety of aircraft and other traffic.

B. PERFORMANCE REQUIREMENTS
   1. Light Bulb : 12V, 100W
   2. Maximum Luminous Intensity value :
      - White beam about 250,000 cd
      - Red beam about 380,000 cd
      - Green beam about 380,000 cd
      (Specification value more than 15% of white)
   3. Light Column Angle : 2 degrees at 1/10 of maximum luminous
   4. Power Supply: AC 220V (Primary side of power supply)
   5. Weight : About 2.4 Kg (Light Shell)
2.9 SPARE PARTS, TEST EQUIPMENT AND SPECIAL TOOLS

A. SPARE PARTS

1. PCBs and Modules

For Air Traffic Communication Control System (including bulbs of Air Traffic Light Gun), the Contractor shall provide a list of PCBs and modules installed per equipment and failure rate per each item, in the technical proposal. The PCBs and modules used during the first three (3) years operation shall be provided.

2. Consumables

The consumables used during the first three (3) years operation shall be provided.

3. Supply after Acceptance

The Contractor shall provide spare parts free of charge if there is any discrepancy in line with installed quantity in the system.

B. TEST EQUIPMENT AND SPECIAL TOOLS

The Contractor shall supply the test equipment and special tools to be uniquely used for the equipment to be supplied by the Contractor.

2.10 PREPARATION FOR DELIVERY

A. PRESERVATION AND PACKAGING

Preservation and packaging of items shall be in accordance with best commercial practice.

B. PACKING

Packing of items shall be in accordance with best commercial practice. No more than one of each item and associated hardware shall be packed in each shipping container.

C. MARKING

Each packing and shipping container shall be durably and legibly marked with the following information:
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<th>Description</th>
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<td>1</td>
<td>Name of item</td>
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<td>2</td>
<td>Serial number(s)</td>
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<td>3</td>
<td>Quantity</td>
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<tr>
<td>4</td>
<td>Contractor number</td>
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<td>5</td>
<td>Gross weight of container</td>
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<td>Manufacturer’s name</td>
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DIVISION 4 : AWOS SYSTEM

PART 1 – DESCRIPTION

1.1 SCOPE

This System Requirements Specification (SRS) describes the requirements for an Automated Weather Observation System (AWOS) to be installed at the Languindingan Airport. The weather information is also used at the Flight Information Service (FIS) for the pilot briefings.

The critical weather data will be distributed to the controller displays (text display) via the dedicated communications links from AWOS. The AWOS shall be designed to utilize the latest state-of-the-art sensors and computer technology available, thereby insuring superior accuracy and performance in the measurement of the aviation weather in the Languindingan Airport. The AWOS includes the functionality of the Runway Visual Range (RVR).

The AWOS as specified herein is to include the weather sensing, data collection, interface communications, and data processing for runway 09/27 in Languindingan Airport.

1.2 REFERENCE

- THE RULES AND REGULATIONS OF THE REPUBLIC OF PHILIPPINES
- ICAO DOCUMENTS
  - ICAO Annex 3
    - International Standards and Recommended Practices. Meteorological Service for International Air Navigation
- FAA DOCUMENTS
  - FAA-G-2100f
    - Electronic Equipment, General Requirements
  - FAA-ORD-6000.32
    - Security Requirements for Remote Access of NAS Facilities, dated 2/3/86
  - FAA-ORD-7110.10
    - Fight Services Handbook
  - FAA-ORD-7340.1
    - Contraction
  - FMH No. 1
• OTHER DOCUMENTS


WMO – No 36   Reduction of Atmospheric Pressure, World Meteorological Organization


Section 11857 Statement of Work for the Integrated Meteorological Information System

1.3 ABBREVIATIONS

The abbreviation/acronyms are used in this specification:

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<th>Definitions</th>
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<td>Alternate Current</td>
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<td>ANSI</td>
<td>American National Standard Institute</td>
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<td>ATCT</td>
<td>Air Traffic Control Tower</td>
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<td>ATIS</td>
<td>Automatic Terminal Information Service</td>
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<td>AWOS</td>
<td>Automated Weather Observing System</td>
</tr>
<tr>
<td>BIT</td>
<td>Built-In Test</td>
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<tr>
<td>CAAP</td>
<td>Civil Aviation Authority of the Philippines</td>
</tr>
<tr>
<td>CAS</td>
<td>Commercially Available Software</td>
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<tr>
<td>COTS</td>
<td>Commercial-Off The Shelf</td>
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<tr>
<td>CTS</td>
<td>Code Tome Source</td>
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<tr>
<td>DAM</td>
<td>Diagnostic Acceptance Measurement</td>
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<tr>
<td>DCP</td>
<td>Data Collection Package</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>DPU</td>
<td>Data Processing Unit</td>
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<tr>
<td>DRT</td>
<td>Diagnostic Rhyme Test</td>
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<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
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<tr>
<td>FAA</td>
<td>Federal Aviation Administration, USA</td>
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<tr>
<td>FIS</td>
<td>Flight Information Service</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphic User Interface</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
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<tr>
<td>LRU</td>
<td>Line Replaceable Unit</td>
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<tr>
<td>MDT</td>
<td>Maintenance Data Terminal</td>
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<td>MER</td>
<td>Message Error Rate</td>
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<tr>
<td>METAR</td>
<td>Aviation Routine Weather Report</td>
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<tr>
<td>MS</td>
<td>Master Station</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failure</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time To Repair</td>
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<tr>
<td>QFE</td>
<td>Atmospheric Pressure at aerodrome elevation</td>
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<tr>
<td>QFF</td>
<td>Atmospheric Pressure at sea level</td>
</tr>
<tr>
<td>QNH</td>
<td>Altimeter sub-scale setting to obtain elevation when on the ground</td>
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<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
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<tr>
<td>RLI</td>
<td>Runway Light Intensity</td>
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<tr>
<td>RMA</td>
<td>Reliability, Maintainability, Availability</td>
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<tr>
<td>RMSE</td>
<td>Root Mean Square Error</td>
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<tr>
<td>RS</td>
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<td>RVR</td>
<td>Runway Visual Range</td>
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<td>SRS</td>
<td>System Requirements Specification</td>
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<td>TD</td>
<td>Touch-Down</td>
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</table>
1.4 **PROPOSAL FOR PRODUCTS TO BE FURNISHED**

The Owner intends to have an AWOS established for Laguindingan Airport for Runway 09/27.

The Contractor’s proposal shall include the description of the products that meet or exceed the performance requirements specified in this specification. The physical configuration of the proposed system may differ from the description in this specification but the performance requirements shall be met. If the proposed configuration does differ from requirements in this specification, the proposal shall contain technical data and the rational to provide sufficient information that all performance requirements are met or exceeded.

The Contractor is mainly responsible for interface with external users and providing the observed weather data to the display systems in ATCT, FIS, ATIS, and others.

The Proposal shall also include a listing of all components including the quantity of each item for the AWOS to be established for Laguindingan Airport. The proposal, in addition, shall include a listing of all tools, test equipment, technical manuals, spare parts and training plans necessary for the operation and site maintenance of the systems to be established.

The technical proposal shall be organized in the same order as this specification, and be accompanied with photos, drawings, and technical installation and operating manuals to aid the owner in fully understanding the technical contents of the proposal. When the proposed products have different characteristics (improvements) from what this specification requires, the proposal shall highlight the corresponding part of the proposal by underlined and bold-type letters to aid owner in identifying changes during the review.

If the Contractor fails to respond appropriately to this System Requirement Specification (SRS) such as failure to provided photos, diagram or description of the performance requirements, etc., so that it is very hard for the Owner to make a judgment, he will be deemed to have no intention to bid.
1.5 **ITEMS AND QUANTITIES TO BE FURNISHED BY THE CONTRACTOR**

The Contractor shall provide all the items necessary to establish and operate one AWOS.

The table below is intended to provide references to the Contractor for developing his technical proposal.

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Runway Visual Range and Ancillary</td>
<td>2 sets</td>
</tr>
<tr>
<td>2</td>
<td>Wind Direction and Speed Sensor Ancillary</td>
<td>2 sets</td>
</tr>
<tr>
<td>3</td>
<td>Ceilometer and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>4</td>
<td>Barometric Pressure and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>5</td>
<td>Rain Gauge and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>6</td>
<td>Ambient Temperature Sensors and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>7</td>
<td>Humidity Sensors and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>8</td>
<td>Main Data Processing Equipment and Ancillary</td>
<td>1 lot</td>
</tr>
<tr>
<td>9</td>
<td>Spare Parts</td>
<td>1 lot</td>
</tr>
<tr>
<td>10</td>
<td>Test Equipment and Tools</td>
<td>1 lot</td>
</tr>
<tr>
<td>11</td>
<td>Instruction Books</td>
<td>5 sets</td>
</tr>
</tbody>
</table>

1.6 **LIGHTNING SURGE PROTECTION**

The internal and external lightning surge protection system to be provided by the Contractor must meet the best industry standards. The Contractor shall also be required to submit an analysis report on the coverage of the lightning surge protection system.

1.7 **OBSERVANCE OF THE CONTRACTOR**

This paragraph contains additional information on the administrative and contractual terms and conditions as follows:

1. The Contractor shall provide qualified engineers or technicians during equipment adjustment, calibration, test, fault isolation, repair, ground support of any data collection.

2. The Contractor shall provide air transportation, lodging, local vehicle, international telephone fee, correspondence and subsistence requirements of the Contractor's engineers or technicians.

3. The Contractor shall be responsible for the safety of personnel and shall be held responsible for and accidents which may occur during the period of this project.
(4) The Contractor shall have the full responsibility for the adjustment, testing, alignment, recovery or replacement of loss and damage to all equipment.

(5) The Contractor shall consult the Owner in case of any contradiction or anything not mentioned in this specification.

A. ACCEPTANCE TEST

1. FACTORY ACCEPTANCE TEST (FAT)

The test shall be carried out at the Contractor’s factory and on his responsibility in the presence of the Owner’s representatives. These shall consist of visual inspections, operation tests, insulation resistance tests, withstand voltage test, earthing test, ratio tests, etc. in accordance with the manufacturer’s standards.

The Contractor shall bear the cost of transportation of the Owner’s representatives and Consultant’s Air Navigation Specialist from/to their hotel, from/to Philippines by regular fare including local transportation from the hotel to the factory site. The Contractor shall also bear the cost for the hotel accommodation and food as well as daily expenses covered by payment of US Dollars 300 per diem by the Contractor to each person. Expenses to be incurred for the two (2) Owner’s representatives and one (1) Consultant’s Air Navigation Specialist spending ten (10) days of stay (inclusive of travel time) shall be included in the proposal.

2. SITE ACCEPTANCE TEST (SAT)

(1) The SAT procedure is a series of tests to be carried out by the Contractor and witnessed by the owner’s representatives. These tests shall be performed to verify the optimum performance of the entire system in accordance with the requirements outlined in the technical specifications of this document and shall include precise tests and evaluations of installation status, performance and operation status.

(2) If any part of the site acceptance test is declared unsatisfactory by the owner, acceptance will not be possible. When the amount of work comes up to the standard in accordance with the installation procedures, acceptance will be accomplished.
3. DATA PREPARATION FOR ACCEPTANCE TEST

The Contractor shall prepare items to be checked and tested for the SAT and shall submit three (3) copies of the data to the Owner not later than two (2) weeks before the start date of the SAT. Data to be prepared shall include the following items:

1. Site acceptance test time schedule.
2. Checklist and formats for the SAT.
3. SAT procedures.
4. Technical and software documentations.
5. Test equipment, tools and spare parts.

4. CHECKLIST AND FORMATS FOR SAT

The checklists and formats for the test shall include the following items:

1. Objective of each test.
2. Status of subsystem prior to each test.
3. Reference value or result to be expected of each test.
4. Actual test value or result during the SAT.
5. Any alignment or remedial action taken during the SAT.

5. SAT PROCEDURES

The acceptance test shall be executed in accordance with the procurement specification and Contractor's proposal to include the following items:

Examine whether all the necessary equipment are perfectly installed.

1. Examine whether all the important system parameters and the related functions are tested.
2. Quantity inspection.
B. UNSATISFACTORY SAT

(1) Should any part of the site acceptance test be declared unsatisfactory by the Owner, the Contractor shall replace the disqualified part or component by satisfactory one. The replacement shall be carried out until the completion date of the equipment installation.

(2) In case that a replacement is beyond the completion date, the Contractor shall compensate the Owner for all damages according to the related laws and ordinances.

(3) The Contractor shall submit a report to the Owner describing the exact cause and remedial action taken for the unsatisfactory test item.

1.8 EDUCATION AND TRAINING

The Contractor shall be responsible for AWOS education and training for owner's staffs for both Contractor's factory training and on-site training (On-the-job training). The Contractor shall prepare necessary education materials and training aids. All training shall be conducted in the English language and the Contractor shall submit the curriculum and training schedule at least two (2) months before the training start date.

A. FACTORY TRAINING

(1) The Contractor shall provide training for two (2) owner’s staffs at the manufacturer's factory. The training course shall be designed to bring up the trainees to a sufficient level for the proper operation and maintenance of the proposed system. The training period of AWOS shall be a minimum of four (4) weeks. The Contractor shall provide the round-trip airfare, training fees, education materials, official trip expenses (Hotel fee, meals, daily allowances), etc. Official trip expenses shall be provided in accordance with the guideline of the Civil service commission of the Philippines.

(2) The training shall be planned to be completed within one (1) month before the starting of equipment installation.

(3) The Contractor shall be responsible for providing transportation facility during the training period on site.

B. ON THE JOB TRAINING

During the on-site shake down test period, the Contractor shall provide on-the-job training for the theory of operation, preventive maintenance procedure, detailed alignment procedure and troubleshooting techniques of the system. On-the-job
training shall be conducted to improve the proficiency level of maintenance staff. Instruction for preventive and corrective maintenance procedures shall be conducted individually per system with introductions to block diagram and schematic diagram analysis.

The number of trainees and training periods that the Owner required for the on-the-job training courses are as follows.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Weeks</th>
<th>Number of Trainees</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWOS</td>
<td>4</td>
<td>at least 5</td>
<td></td>
</tr>
</tbody>
</table>

C. REQUIREMENT OF FACTORY TRAINING COURSE

All training courses shall include separate chapters for theory and practice, hardware and software. After completion of the training, trainees shall be able to isolate and restore defective hardware modules or cards, and fully understand the architecture of hardware and analysis of operating system and application software.

1.9 DOCUMENTATIONS

The Contractor shall provide technical manuals and related documents written in the English language.

A. QUANTITIES OF REQUIRED DOCUMENTS

(1) Installation plan and drawings : 3 copies
(2) System inspection and test reports : 2 copies
(3) Training plan : 1 copy
(4) Training manual and materials : 1 set for each trainee
(5) Technical manuals (English) : 5 copies for each equipment.

B. TECHNICAL MANUALS

The manuals shall contain the following chapters:
(1) General and functional descriptions for each subsystem.
(2) Equipment installation procedure and theory of operation.
(3) Preventive maintenance procedures and corrective maintenance procedures.
(4) Troubleshooting procedures.
(5) List of bench stock items with their types, part numbers, and quantities.
(6) Parts illustrations and pictures.
1.10 WARRANTY

The Contractor shall warrant that no system breakdown or performance degradation will be encountered for three (3) years after the date of final acceptance. During the warranty period, the Contractor shall provide materials and technical services without any cost to the Owner. However, the Contractor shall be responsible for equipment problems caused by any design and production faults regardless of warranty period. So when those problems occur, the Contractor shall replace defective required parts of equipment with new parts without any cost or additional compensation.

PART 2 – PRODUCTS

This part contains the system requirements and quality factors for the AWOS. The requirements are cited for the system characteristics, sensors, data collection and data processing elements.

2.1 SYSTEM DESCRIPTION

The AWOS shall automatically collect, process, verify, archive, format and report the weather elements necessary to support aviation operations. The AWOS shall include weather information gathering sensors, software driven computer systems with peripherals, displays and workstations. The AWOS shall be designed to satisfy the ICAO, WMO and FAA requirements and perform to meet CAT-I operation in the Laguindingan Airport.

The AWOS shall be configured to measure the Laguindingan Airport weather condition accurately and reliably while maximizing the safety of the airport operation.

2.2 SENSORS

A. DESCRIPTION

The AWOS sensors and related equipment shall be installed at the appointed area near the touchdown zone of 09/27 approach runway. The Contractor shall verify the sensor locations in accordance with ICAO recommendations.

The Figure 1 shows the location of the AWOS sensors:
The temperature, humidity, present weather and precipitation accumulation sensors shall be located as shown in Figure 1. Two (2) Runway Visual Range (RVR) visibility sensors, two (2) sets of transmitter-receiver, with double baseline configuration shall be located at both ends of runway as follow as Figure 1. The AWOS shall have the capability to accommodate two (2) more RVR sensor data. The AWOS shall have the capability to monitor the runway light intensity setting and shall use the monitored value to calculate the RVR.

Listed below are the sensors that shall be part of the AWOS.

- Ceilometer : 1
- Runway Visual Range : 2
- Wind Direction and Speed : 2
- Barometric Pressure : 1
- Rain Gauge : 1
- Ambient Temperature : 1
- Humidity : 1

The sensors shall measure the required meteorological data in the form of a signal representative of the sensed weather element. Each sensor/DCP interface shall be standardized so that sensors are interchangeable with spares requiring on-site manual adjustment.

The mounting for transmissometer and wind/AWOS masts shall comply with ICAO fragility requirement and shall be designed for easy maintenance in accordance...
with ICAO recommendation Annex 14. The mounting shall include obstruction light and shall be protected from lightning.

B. METEOROLOGICAL SENSORS’ CHARACTERISTICS

The meteorological sensors’ characteristics are derived from FMH-1, ICAO Annex 3 and WMO Publication 49 and 306.

The sensor design shall incorporate features which enable the MDT to check its status and functions and isolate failures to specific modules. The sensors shall be capable of being calibration devices supplied by the Contractor. The sensor shall not lose calibration when power is lost.

1. Wind Speed Sensor

The wind speed sensor shall be located near the touch down zones and shall be observed at 6 to 10 meters above runway surface. The wind speed sensor shall have the following performance characteristics:

- **Range**: 0 to 125 Kts
- **Accuracy**: 1 knots or 5%, whichever is greater (at wind speeds > 10 knots)
- **Distance Constant**: Less than 30 feet
- **Threshold**: 5 knots
- **Resolution**: 1 knots
- **Time Averaging**: 2 minutes, 10 minutes
  3 seconds for Gust
- **Update**: 5 seconds
- **Response time**: 1 Second

2. Wind Direction Sensor

The wind direction sensor shall generate the azimuth angle of wind direction with respect to true north. It shall have the following characteristics:

- **Range**: 0 to 360 degrees in azimuth
- **Accuracy**: 0.3 degrees
• Resolution : 1 degree
• Time Averaging : 2 minutes for Magnetic North 10 minutes for True North
• Update : 5 seconds

3. Air Temperature

The AWOS shall be provided with temperature sensor to measure air temperature (Ta) and dew point temperature (Td). These sensors shall have the following characteristics:

• Temperature Range : -40°C to +65°C
• Temperature Accuracy : ±0.3°C
• Temperature Resolution : 0.1°C
• Ta – Td Spread : 0 ~ 63
• RSME Accuracy at
  T>0 – C :
  Ta – Td: 0°C to 23°C 2°C
  Ta – Td: 23°C to 36°C 3°C
  Ta – Td: 36°C to 63°C 5°C
• Resolution : 1
• Time average : 1~5 minutes (minutes settable by user)

4. Humidity Sensor

The AWOS shall provide the relative humidity and shall meet the following characteristics:

• Range : 5 ~ 100%
• Accuracy : ±2%, less than 90%
            ±3%, 90% ~ 100%

5. Pressure Sensors

One (1) identical pressure sensors shall be used to measure average airport
barometric pressure. The characteristics of a sensor shall be as follows:

- **Range**: 850 to 1060 hpa
- **Accuracy**: 0.3 hpa
- **Resolution**: 0.003 inch Hg
- **Interrogation Rate**: Once every 10 seconds

The QNH, QFF and QFE shall be reported.

6. **RVR Transmissometer**

The RVR Transmissometer shall be capable of measuring the extinction coefficient of the atmosphere over a given range. The sensor shall be compact, lightweight, easily serviced or removed and transported by one individual. The sensor shall be designed for installation as double baseline configuration.

The sensor’s mean error shall not change by more than 10 percent during any 3 months period, as determined by the sensor’s calibration device. The sensor performance shall not be affected by sunlight nor any rapid changes in ambient levels.

- **Range**: 0 to 3,000 m
- **Accuracy**: Nominal 3 m at visual range up to 3Km
- **Time**: Less than 10 seconds
- **Eye Safety**: Conform to Acceptable Emission Limits for Laser Radiation, with Class 3b maximum accessible emission level applied to direct viewing without
optical instruments (excluding ordinary eye glasses).
An interlock device shall disable the laser during maintenance thereby preventing personnel from inadvertent exposure to laser emission.

1. Ceilometer

The ceilometer shall report cloud information twice per minutes. The ceilometer shall have the following characteristics:

- **Range**: Surface to 12,000 feet (3,600m)
- **Accuracy**: ±10m (below 1,000m); 30m (above 1,000m)
- **Resolution**: 10 m
- **Eye Safety**: Conform Acceptable Emission Limits for Laser Radiation, with Class 3b maximum accessible emission level applied to direct viewing without optical instruments (excluding ordinary eye glasses). An interlock device shall disable the laser during maintenance thereby preventing personnel from inadvertent exposure to laser emission.

2. Precipitation Accumulation Sensor (Rain Gauge)

The sensor shall measure precipitation, liquid or frozen, in increments (resolution) of 0.25 mm. The sensor (or gauge) shall be able to catch at least 1016 mm of liquid or frozen water equivalent without intervening maintenance; higher capacities will be desirable. This is based on the need
to capture maximum precipitation events. A wind shield may be installed around the gauge to reduce wind updrafts and wind streamlines that alter rain trajectories. The sensor device shall include the mechanism to melt non-liquid precipitation types.

- **Range**: 0 ~ 10 inches per hour (0 ~ 1016 mm)
- **Accuracy**: ±5% per 100 mm
- **Resolution**: (0.02) (0.5 mm)

### 2.3 DATA COLLECTION PACKAGE

#### A. DESCRIPTION

The Data Correction Package (DCP) shall contain the sensor interface circuitry, maintenance and fault isolation test set, communication and support circuits to interface with Data Processing Unit (DPU). The sensor interface electronics shall acquire the analog or digital sensor output signals, process the data (if appropriate), and format and transmit the data to DPU. The sensor interface electronics may be an integral part of the sensor, or may be in a separate package, collected with the sensor. The DCP shall be capable of collecting data from an array of AWOS sensors and format it into a serial stream for transmittal to the AWOS DPU through communication cable. The DPU shall transmit the data to the DPU using an industry standard data communications protocol with error detection capability. Sensor data with transmission errors shall not be processed by the DPU. The redundant communication path between DCP and DPU shall be implemented.

The sensor interface electronics shall be controllable by the portable maintenance data terminal (MDT) locally at the DCP location and remotely from the Meteorological Office. The DCP shall accept the built-in test (BIT) input from the sensors, insert its own BIT signal, and pass the resulting information to the DPU. The sensor interface electronics shall contain the capability to perform sensor calibration and sensor interface electronics maintenance diagnostics via the MDT.

In addition, the DCP design shall include the EMI/RFI protection, lightning protection, backup charge source, and line transient and over-voltage protection with automatic reset.

The DCP shall be equipped with the outdoor enclosure, connectors, mounting hardware and any other components required for a complete unit.

#### B. PERFORMANCE

The DCP shall perform the following functions:
1. Sensor output standardization

   The DCP shall sample sensor and sensor status signals, and shall convert the output from the sensors into digital format which preserves sensor resolution and accuracy.

2. Capacity

   Each DCP shall be capable of accepting the sensors required under this specification with an expansion capability.

3. Sampling Rate

   The sensor sampling rate shall be controlled by the software developed to satisfy the ICAO display requirements, and AWOS and RVR algorithms’ requirements.

4. Data Format

   The DCP shall combine the digitized analog output signals and other DCP data into a signal serial data stream. The data format shall uniquely identify each data source.

5. DCP Controller

   Operation of the multiplexers, converters, data formatting and transmission shall be under control of a DCP controller. In case of a power failure, sensor/DCP or DCP/DPU communication failure or error, or any other disruption of sensor or DCP operation, upon alleviation of the disruption the DCP controller shall be automatically reinitialized to produce normal operations. When this situation occurs, an identifying signal shall be provided to the BIT data.

6. BIT

   The DCP, in conduction with the DPU, shall monitor the operation of the circuits and other devices for proper operation, (e.g., AC and DC power sources, the DCP enclosure temperature, sensor operation, aspirator fans and transmission modes).

7. Power monitoring and power reset

   The DCP shall constantly monitor AC and DC power associated with its operation. If any output power exceeds limits which could result in component damage, the source shall be either clamped or disconnected and an appropriate signal shall be sent to the BIT system data. When the power
returns to normal, it shall be automatically reconnected. The power monitoring circuit shall operate from a trickle-charged battery (100 hour endurance) in order to insure uninterrupted operation.

8. EMI/RFI Protection

The DCP design shall include EMI/RFI protection, and line transient suppression devices (with automatic reset) on all input and output communication lines and power lines.

9. Data Transmission

The DCP shall transmit the data to the DPU using a data communications protocol which shall enable the receiving unit to detect transmission errors and retransmit, if required. Recurring errors in transmission shall be reported to the BIT system. Bit error rate shall not exceed 10^-6. The DCP shall contain any required communication devices to transmit all the data to the DPU.

2.4 DATA PROCESSING UNIT

A. DESCRIPTION

The Data Processing Unit (DPU), located in the Meteorological Office, shall collect the weather data from DCP, generate weather products, archive data, and distribute data. The DPU also shall generate the voice messages of weather information when requested via telephone links. The DPU shall have the capability to operate and to download the software from a remote site via telephone link. The DPU shall utilize a fault tolerant design approach or a dual computer installation (hot standby) with automatic and/or manual switch-over.

The four main functions of the DPU are data acquisition, data reduction, data processing and product dissemination. The DPU shall accept data inputs, performs various data reduction functions, implement the algorithms and prepare weather observation reports. The DPU shall be responsible for maintaining real time, archiving, system control, and maintenance diagnostic and reporting functions. The DPU shall include the central processing units (CPUs), system software, necessary modems, BIT circuits, a power supply and a cabinet. The DPU software shall include the algorithms for data reduction of the various functions. The provided AWOS shall be designed to permit modification or change in the algorithms without major changes to the hardware or software/firmware.

The main DPU functional requirements are listed below:

1. The DPU shall perform data acquisition, data distribution, archiving,
operator interface, self-testing and diagnostics, and product output with or without the attendance of an operator. The system shall generate Aviation Routine Weather Report (METAR), SPECI observations, and SYNOP in the formats recommended in WMO No. 36 Supplements 4 (Current version). The local Maintenance Data Terminal (MDT) shall be provided to override or add to the automatically generated weather observations and to control data quality checks, and prepare multiple reports in a variety of formats for distribution. These data shall also be archived to provide an historical database.

2. The DPU shall interface with workstation and display to perform data (maintenance and status data) exchange and weather product dissemination.

3. The DPU shall have the hardware and software necessary to perform the following:
   a. System timing and control
   b. Data acquisition and communications
   c. Data processing
   d. Data formatting and storage
   e. Data quality checks
   f. Archiving
   g. Power control and distribution
   h. Data output
   i. Voice Messaging

4. The DPU shall utilize a highly reliable redundant computer architecture which insures continuous service to the system users (i.e., controllers, pilots) in case of a component failure.

B. PERFORMANCE

The following paragraphs describe the functional characteristics of the DPU.
1. Data Acquisition

The DPU shall have the capability to receive sensor input as well as system diagnostics information directly from the DCP. The DPU shall calculate a message error rate (MER) based on all messages transmitted/received at the DPU. The alarm generation algorithm shall use a sliding time window methodology.

2. Data Reduction

This function consists of the pre-processing of information prior to the actual algorithm processing. The Contractor shall design quality control checks (BIT data checks) into the AWOS data reduction software to ensure that the data received by the DPU are accurate and complete, and that the associated equipment is working properly. If data from any sensor is erroneous or missing (e.g. the sensor loses power, etc.), that parameter shall be reported “failed” in the weather observation, and an appropriate signal shall be sent to the BIT data. Quality control checks shall be made on sensor data prior to its being processed. Sensor data shall not be accepted by the DPU unless its own checks and those of its associated DCP are passed. Where the acceptable criteria for any data reduction checks are not specified in this specification, the Contractor shall propose criteria to be approved by the Owner. Some examples of sensor checks are as follow:

a. Reference or calibration point checks (e.g., reference voltage; airflow; sensor heater current, etc.) shall be used to periodically test as many sensor functions as are practicable to provide confidence of proper operation.

b. Upper and lower limit checks can be set corresponding to the operating limits of a particular sensor, or by the real-world installation limits of the processing algorithms. These are the gross error checks that will prevent reporting clouds below ground level, negative wind speeds, etc.

c. Rate-of-change limits provide a failure detection criteria. For example, the temperature sensor may have upper and lower limits of +658C and -408C, but a rate-of-change limit might be set by determining the maximum acceptable change in temperature or signal characteristics over a given period of time. Any data limit anomaly shall be stored in maintenance history to indicate potential trends that a sensor or its communication line may be deteriorating.

d. The sensors shall incorporate data checks which depend upon the history of the sensor output to uncover existing or potential system
problems or failures. For example, the mean and standard deviation of a sensor measurement can be calculated every hour. Upper and lower standard deviation limits can be established. Other examples of data checks include consistently low wind speeds, unvarying wind speed or direction, lack of visibility of more than five miles for long period, a consistent cloud or a lack of clouds for long period, etc.

3. **Data processing**

The DPU shall implement the sensor algorithms and shall prepare the processed data as a weather observation in a digital format.

   a. **Weather parameter algorithms** - The appropriate AWOS algorithms shall be used to generate the weather parameter product. Any proposed changes in the algorithms shall be submitted, along with justification, to Owner for approval.

   b. **Products** - Contractions used in the MDT and weather message to the displays shall be as required by FMH-1 (Surface Observations) and FAA-ORD-7340.1 (Contractions).

4. **Product dissemination**

The DPU output shall be routed automatically to those output ports. The DPU also shall respond (output) to appropriate input commands by inquiry from the MDT. The DPU shall output its various products via the interface ports to the following:

   a. Provided all the weather products in textual and graphical forms

   b. Provided all weather products and alerts

   c. Up to 5 local voice subsystem telephone answering devices

METAR reports shall be generated and distributed twice per hour. SPECI reports shall be distributed on certain weather conditions. The weather data shall be provided for exchange in international distribution network.

5. **Archive data**

The DPU shall archive the AWOS weather products in the hard disk and shall be available on demand for the MDT display. The AWOS shall have a removable disk drive to dump the data from the DPU. Operational archive
data shall be available for a specific date and time, or for a specific date and a block of times. The response time from request to display of any archive data shall not exceed five seconds. If the archived data exceeds the storage capacity, the priority for storage shall be for the most recent operational data.

Archived data for AWOS products shall consist of the following:

a. AWOS observation raw data for 24 hours and weather products for 30 days with day, hour, minute, second shall be archived and provided as a system output for use in displays, workstations, synthesized voice output, etc. The day shall be expressed in the Gregorian Calendar. Hours and minutes shall be indicated numerically from 0000 to 2359 with the H+00 observation being the hourly data. The clock function shall be accurate within 1 second at any time and shall be adjustable via MDT.

b. A history of any product augmentation performed on the above archived observations. This history shall include the AWOS automated observation, any manual changes (i.e., the revised observation), and the initials of the editor.

6. **System control**

The DPU software shall provide the control of the AWOS system through the use of the MDT at the Meteorological Office or at a remote site via telephone link. A menu of control options shall be available for presentation on the MDT. Passwords shall be used to limit on-site access to authorized users only. System control functions shall include:

a. Monitoring Current Output - The DPU shall monitor the current output of the AWOS system.

b. Retrieval of data - Retrieve historical weather observation data by displaying archived data.

c. Product augmentation - This function allows an authorized observer to augment any observation product. (A specific password shall control access to the editing function.) Edited products shall include the initials of the editor (initials will not be disseminated with any observation product but will be archived internally by the DPU, along with the modification and the automated data that was overridden). Manual entries of weather phenomena not automatically observed shall be placed in the comments section of
the observation. In the case of a sensor failure or an incorrect AWOS output, an operator shall have the capability to replace the incorrect parameter value with a “missing” symbol and to manually enter a corrected value. The MDT shall provide the means for an hourly acknowledgement of the manually-entered data verifying its validity to the users. An authorized observer shall have the capability to:

- Monitor the current observation, including any manually entered data.
- Augment any observation product.

d. System modification - This function shall allow the MDT operator to reconfigure the AWOS system. It shall include the capability to set the clock, or disable any sensor, and to reconfigure system components (e.g., to compensate for a sensor or communication failure).

e. Provide maintenance diagnostic data - A variety of information is required to facilitate the identification of system problems and/or failures to a local technician. The following maintenance data shall be archived and available at the MDT:

1) Configuration report shall give the descriptive code of all AWOS options (sensors, displays, workstations, communications channels, software (including product thresholds and software version identifier) and system constants). A prominent indication (e.g., blinking or reverse video) of any error, failure or non-standard condition shall be reflected on the video display.

2) A hardware status report shall give the status (on/off, deactivated, failed) of all AWOS hardware installed. This report shall contain a prominent indication of any error, failure, or non-standard condition.

3) 30 days maintenance data record shall be maintained by the DPU, that reflects the date and time the system or any subsystem failed, and when it was returned to service.
4) DCP and DPU software identification and version number(s).

5) Raw (unprocessed) AWOS sensor data. Separate files shall be maintained for each sensor. The raw sensor data shall be available for retrieval and shall also be available for schedule retrieval on a periodic (one, 15, 30, 60 minutes) basis. The raw sensor data samples used by the DPU to process the weather algorithm at the time of retrieval shall be available for retrieval.

6) AWOS-generated BIT information.

7) A history (action, time, person) of any modifications to the system.

8) AWOS observation output.

9) The number of incoming calls recorded by the telephone answering device.

f. Perform Maintenance diagnostics - The BIT parameters of the entire system shall be available through the MDT. Through the use of this information and appropriate keyboard or pointing device entries, system faults shall be isolated to the LRU level.

2.5 RVR ALGORITHMS

The computation of RVR shall be based on Allard’s and Koschmieder’s Laws. The RVR automatically measures the extinction coefficient, ambient luminance and runway light intensity in order to calculate the runway visual range. The RVR product algorithms shall meet with the ICAO/WMO standards. The DPU shall generate the RVR products for the runway and distribute the RVR value continuously to all aviation related displays. The RVR value shall meet the following accuracy requirements:

For a precision approach, RVR shall be reported when it is below 1500 meter. The RVR observations and reporting shall be based on the final update of the ICAO Annex 3 for the reporting METAR and SPECI.

2.6 INTERFACE

The DPU shall have the capability to accommodate all necessary interfaces to the DCP, aviation weather displays and workstations, and all other peripherals. All interfaces shall utilize industry standard communications protocol(s) and implement redundant communications architecture.
A. REQUIREMENTS

1. The DPU shall have the interface with the DCP.

2. The DPU shall have an interface port to allow operator (i.e., observer, controller, technician, and system manager) interface with the DPU via MDT. The Contractor shall provide a dedicated MDT at the Meteorological Office.

3. The DPU shall have the interface with a color laser printer to produce hard copy of the information such as weather graphics, METARs, SPECIs, one-minute observations, maintenance information from the BIT function, etc. The Contractor shall provide the industry standard color laser printer at the Meteorological Office.

4. The frequency of the data report from the DPU to the users at ATCT and Meteorological Office shall be ICAO compliant.

5. The DPU shall have interfaces to distribute its products to the controller displays (text display) in the ATCT. The Contractor shall implement the COTS and industry standard dual communication links between the DPU and the items shown below. The DPU shall have the interface capability to accommodate following displays:
   a. Two (2) text displays at the ATCT.

6. The DPU shall have a port to allow an external data acquisition system to gather real-time sensor data.

B. CLOCK

The AWOS shall be synchronized with the system clock provided from Master clock.

2.7 EXPANDABILITY AND FLEXIBILITY

All hardware shall be designed and constructed in accordance with FAA-G-2100f, RTCA DO-216, or the best commercial practice for airport equipment. Open software and hardware architecture shall be used for future expansion, flexibility, and integration.

The AWOS shall contain a reserve memory capacity of 50%. CPU loading shall not exceed a capacity of 50% when averaged over one (1) minute period. Secondary storage (both
removable and non-removable disk storage) shall contain excess capacities by demonstration. The DPU shall contain 50% more memory and interface capacity than necessary to accomplish the requirements of this specification, for future expansion.

The AWOS shall be capable of accepting different sensor types, and of upgrading with newer, improved sensors without requiring hardware redesign or major software changes.

2.8 SOFTWARE

The AWOS operational software shall be provided for the operations of the DCP and the DPU functions. The AWOS software shall be designed for fail-safe real time operation. These fail-safe shall be designed to guard against loss of data presentation of invalid or false data to the users.

The Contractor shall provide the operational software needed to make the AWOS function in accordance with this specification. The operational software shall include the algorithms needed to convert the meteorological sensor data to scientific observations, and format observations to meet the display and transmission requirements. The standard ICAO/WMO recommended AWOS algorithms shall be used. The software shall be written in accordance with the best commercial practice.

The software shall be programmed in a high order language. Exceptions may be made for simplified routines (such as wind averaging), for off-the-shelf software or when execution time is critical.

The software shall be written in the “C” and/or “C++” language and full source code shall be supplied.

The system shall use a standard, unmodified graphical user interface (GUI), multi-tasking, multi-windows, COTS operating system. The use of commercially available software (CAS) also known as COTS is encouraged upon the approval by the Owner. The software shall be downloadable via telephone link.

The software architecture shall minimize the complexity of interfaces between software units and keep unrelated functions separated. There shall be design traceability between successively more detailed levels of abstraction from the most abstract level to a level sufficient for code implementation. Each level shall be complete and independent, containing definitions of data and the operations on the data.

The AWOS specific developed software shall have the capability to detect, store, and notify the occurrence of software error. The location in the software (unit identification) and time of occurrences shall be archived, and recovery from abnormal conditions shall be provided. The system shall accept only appropriate commands. The system shall respond with plain language message to inappropriate commands. In no case shall any casual keyboard entry or lack of entry cause the AWOS to change state, lock-up, or halt the AWOS. The Contractor
shall provide the support software, a package of application independent software used in developing, testing, modifying, and producing the operational software.

2.9 BUILT-IN TEST

A. DESCRIPTION

The equipment shall be designed in modular elements for quick, easy replacement in the event of failure. Maintenance functions and features shall be integrated in a modular manner to minimize the time required for fault detection, fault isolation, testing, repair and service restoration by making maximum use of current automation techniques and centralized maintenance control. The fault isolation shall detect a failed component to the LRU level with an accuracy of 95%.

A Built-in Test (BIT) subsystem to run in real-time to detect misaligned or malfunctioning sensors is required. The BIT function shall have the hardware and software necessary to monitor, determine, and report on the status and performance of all AWOS components and related interfaces. The BIT shall provide the technician the capability to perform maintenance tasks while on-site at the Laguindingan airport. The AWOS shall have test plugs and points and maintenance equipment ports to fully utilize the diagnostic capabilities of the BIT. With the BIT, a trained technician shall be capable of isolating DPU and transmission (line, radio, etc.) failures and, after making repairs, re-calibrate the system prior to restoring it to service.

The diagnostic capabilities shall guide the technician to the unit, module, card, etc., requiring repair, replacement or calibration in a time short enough to meet the MTTR specifications. Acquisision, processing, and reporting of BIT data shall not interrupt or impair operation of the AWOS. The DPU shall have the capability to control/command/display the result of the BIT from either at on-site or at the Meteorological Office.

B. PERFORMANCE

1. Collect the performance parameters of the AWOS (i.e., the DPU, the DCP and their own internal hardware and software elements and sensors) which are required in the determination of the equipment operational status. Identify equipment out-of-tolerance conditions and failures.

2. Perform self-tests in order to check equipment and subsystem operation. In performing these tests, simulated data in the correct format shall be used as inputs to the appropriate AWOS elements (hardware or software) in order to test their proper operation. An example is a loop back test on the
communication link.

3. Perform demand tests and display the results and output from each subsystem under test in a form that easily understood by the operator.

2.10 OPERATIONAL ENVIRONMENT

The AWOS and its components shall be designed, fabricated and tested to withstand the Environment III conditions for equipment installed outdoor and Environment II for facilitated equipment in accordance with FAA-G-2100f. In either case, the AWOS equipment shall meet all its functional and performance requirements. The system shall be able to operate in those environments 24-hours-a-day, 365-days-a-year.

2.11 RELIABILITY, MAINTENABILITY, AVAILABILITY REQUIREMENTS

A. RELIABILITY

The Contractor shall state the proposed system Mean Time Between Failure (MTBF) with the Proposal.

B. MAINTENABILITY

The Contractor shall state the proposed system Mean Time To Repair (MTTR) with the proposal.

C. PERIODIC (SCHEDULED) MAINTENANCE TIME

The AWOS system shall be designed such that periodic maintenance shall not be required on a scheduled basis more than four (4) times per year.

2.12 DC BATTERY POWER SUPPLY

The AWOS (Data Processing Unit) shall operate using a continuously charged DC battery power supply system which will support a continued, uninterrupted normal operation in the event of a main power failure. The Contractor shall state his strategy for operating uninterrupted power for all systems AWOS (Data Processing Unit). The Proposal shall contain the minimum running time using the proposed battery power source when mains supply is removed, including the critical battery discharge point for each facility type, the time required for self-restore capability to recharge flat batteries up to 100%, and where and how to install the battery packs.

When primary power is restored, the state of the battery shall in no way cause harm to or affect the operation of the respective subsystems.
2.13 MAINTENANCE DATA TERMINAL

The Maintenance Data Terminal (MDT) shall consist of a video display and a keyboard with pointing device which may be a portable unit. It shall be used as the operator control for the AWOS.

A. DESCRIPTION

The MDT will be used by an operator to monitor the output and status of the system, augment and/or modify system outputs, control and display the AWOS weather data, reconfigure the system, receive and display system failure messages, and perform BIT functions. The MDT shall include a video display terminal, keyboard, pointing device, and any necessary processing interfaces. The MDT shall enable an operator to perform the system control functions, e.g., monitor current output, retrieve data, put a parameter missing, add comments to end of the observation, provide maintenance diagnostic data, and perform maintenance diagnostics.

B. PERFORMANCE

1. AWOS monitoring

   At the request of an Operator, the MDT shall display the requested information. When requesting archived data, it shall be possible to specify the time block in which data is requested, such as any specific observation or any block of observations during a specific time period, it shall be paged or scrolled under operator control.

2. Manual data entry

   The entry of data shall be facilitated by special keys on the MDT keyboard or by pointing device.

3. Error Detection

   The AWOS processor shall check for incorrect entries by the operator, such as an altimeter setting which is out of the preset station pressure limits. Entry of apparently incorrect data shall result in an error message on the display followed by text or a code indicating the reason for rejecting the data. The MDT shall contain an override procedure to permit entry of unusual but accurate information.
4. **Security**

   The MDT shall be designed to prevent unauthorized persons from entering data into the system.

5. **AWOS status monitoring**

   The MDT shall provide a system operator the capability to monitor the system status. Using the MDT, an operator shall be able to obtain the system data and perform data and perform the system BIT functions.

6. **Electronic Maintenance Manual**

   The MDT shall provide the user the electronic maintenance manual which can be used by technician during the troubleshooting.

7. **Remote Access**

   The MDT shall have the capability to log in from remote site via telephone link. The MDT shall have the capability to download the software from the remote site. The MDT also shall have the capability to control the AWOS from the remote site via telephone link.

8. **Print**

   The MDT shall have the capacity to direct the DPU to print the requested data by the operator.

### 2.14 Voice Message

#### A. **DESCRIPTION**

The AWOS shall include the computer generated voice and telephone answering unit. The unit shall use the digital weather product to generate a high quality computer generated voice message. It shall have the capability for the addition of a manually input voice message from a workstation (a maximum of 30 seconds duration) at the end of the computer generated message. It shall incorporate an error checking scheme to prevent erroneous outputs resulting from the transfer of digital data and the development of the voice message.
B. PERFORMANCE

The voice unit shall contain the functions of speech generation and processing. Voice output shall be a balanced, low-impedance driver providing a nominal 1 milliwatt of power into a 600 ohm line. The output amplitude shall be adjustable (±2dB) with a nominal 0 dB output. The output shall be capable of driving unconditioned telephone lines, dial or dedicated.

1. Voice Generator

The voice generator shall have the following features:

a. The computer generated voice message shall be output continuously with approximately 5 seconds delay between the completion of one weather observation and the beginning of the next. The telephone answering device shall respond (answer) by the end of the second ring, and the AWOS message shall begin (in mid-message, if necessary) within five seconds thereafter. Two complete AWOS messages shall be broadcasted before automatically terminating the call. A counter shall be included in the system to count and report the total number of incoming calls each 24 hours (0000 – 2359 hours).

b. If the voice message is in process of output when a new AWOS observation is received, the output message shall be completed without interruption; voice transmission of the new AWOS observation shall begin upon completion of the next delay time.

c. The clarity and phrasing of the automated speech shall provide high intelligibility from telephone. The intelligibility shall be a minimum of 90% (2400 bits per second) as measured by the Diagnostic Rhyme Test (DRT). The quality of the automated speech shall be a minimum of 50% (2400 bits per second) as measured by the Diagnostic Acceptability Measure (DAM).

d. The format and sequence of the voice message shall be in accordance with FAA-ORD-7100.10, Flight Service Handbook. The time of the observation shall be given after the location identification. The voice generator shall have the capability to prefix the voice message with “this is a test”, when necessary. When any weather parameter is reported :MGS" (missing) by the DPU (due to a disabled sensor or an inoperative sensor, as determined by internal AWOS checks) and not augmented by a manual input, the voice report shall be “(parameter) MISSING,” e.g., “WIND SPEED MISSING,” “CLOUD HEIGHT MISSING”. etc. When the parameter shall not be reported “missing”, and the observer’s observation shall be announced in the manual input segment as “comments”.

e. In the event that valid data is not received prior to the start of the next voice transmission, the last valid data set received shall be used to compose the voice message. Failure to receive a data update for more than five minutes shall result in the termination of the voice output and generation of a failure message to the BIT system. In this event, the voice generator shall output the message “(station identification)” automated weather observing system temporarily inoperative.

f. The voice unit shall circuits necessary for monitoring of its status.

g. The voice system shall contain a speaker and a headset jack for monitoring the voice output.

2. Processor

An industry-standard microprocessor/microcomputer shall control operation of the voice subsystem. It shall store the latest weather observations in memory, compose the voice message from the stored vocabulary and output the data to the voice generator for conversion to speech.

3. Speech Generator

A voice generator shall receive data words from the microcomputer and convert them to an analog signal representing speech. The technique used shall be any technique yielding high quality speech. The voice unit shall be able to accommodate a two-line observation (160 characters per observation).

4. Vocabulary

The vocabulary shall include all words necessary to produce a voice message in accordance with FASA-ORD-7110.10. The voice unit will have a capability to provide an eventual 400-words vocabulary to support AWOS expansion that includes RVR reporting and the following sensors: Thunderstorm, present weather, laser weather identifier, obstruction to vision, and runway surface condition.

2.15 HARDWARE DESIGN AND CONSTRUCTION

A. GENERAL REQUIREMENTS

All hardware shall be constructed in accordance with FAA-G-2100f, RTCA DO-216, or the best commercial practice for airport equipment. The DPU components shall be rack-mounted. The AWOS shall be modular to the extent that failed components
are easily replaceable modules with the modularization based on the LRU definitions. Accessibility to racks and LRUs shall be in accordance with FAA-G-2100f.

The structural strength and rigidity of the equipment units shall be such that common carrier handling in loading, shipping, unloading, and setting into position for installation shall not cause damage or deformation to any AWOS component nor deformation to the equipment units.

The cabinets and frames for the AWOS equipment shall be designed for an average weight distribution of floor loading not to exceed 610 Kg/sqm (125 lb/ft²)).

B. SAFETY

AWOS equipment shall be designed and constructed so that the potential for personal injury during installation, operation, maintenance or repair of any system components is minimized.

C. SYSTEM SECURITY

The remote station equipment to be provided by the Contractor which intended for ground level installation shall be provided with a suitable locking mechanism.

All sensor poles shall include obstruction lights in accordance with the Philippines Aviation Act.

D. ELECTROMAGNETIC COMPATIBILITY

The AWOS shall not interface with other systems when it is installed and shall operate compatibly in its installed environment according to the NDI/COTS EMI requirements in FAA-G-2100f.

E. GENERAL POWER REQUIREMENTS

The AC power source for each equipment shall be as follows:

• Voltage : 220V ±10% (three phase)
• Frequency : 60 ±3 Hz

Each equipment shall automatically shut-off for any abnormal power supply, and shall also be designed for the computer programs not to be damaged by the abnormal power supply.
F. SECURITY

The Contractor shall provide hardware and software safeguards meeting the requirements of FAA-ORD-6000.32 paragraphs 6, 7, and 8 to prevent the unauthorized or inadvertent input, change or cancellation of AWOS system data. System security shall be a subject in the design verification reviews.

G. OUTDOOR ENCLOSURES

Any electronic equipment to be installed outdoors shall be designed to operate and survive in an unprotected environment. The equipment enclosures shall protect the equipment from intrusion by animals, birds and insects.

2.16 SERVICE LIFT

The AWOS system shall be designed and constructed to have an operating service life of 20 years with normal maintenance and replacement of failed parts.

2.17 INSTRUCTION BOOKS, TEST EQUIPMENT AND SPARE PARTS

A. INSTRUCTION BOOKS

Five (5) copies of the instruction books needed for installation, check-out, alignment, calibration and maintenance of AWOS equipment shall be furnished with the system.

B. TEST EQUIPMENT AND TOOLS

1. The test equipment and test tools require for installation, check-out, alignment, calibration, operation and maintenance of AWOS system shall be furnished with the system.

2. The proposal shall include a list of basic standard and special test equipment. Any special test equipment required shall be presented as an optional separate item with the cost proposal.

C. SPARE PARTS

1. PCBs and Modules

For AWOS, the Contractor shall provide a list of PCBs and modules installed per equipment and failure rate per each item, in the technical proposal. The PCBs and modules used during the first three (3) years
operation shall be shall be provided.

2. Consumables

The consumables used during the first three (3) years operation shall be provided.

3. Supply after Acceptance

The Contractor shall provide spare parts free of charge if there is any discrepancy in line with installed quantity in the system.

2.18 PREPARATION FOR DELIVERY

A. PRESERVATION AND PACKAGING

Preservation and packaging of items shall be in accordance with best commercial practice.

B. PACKING

Packing of items shall be in accordance with best commercial practice. No more than one of each item and associated hardware shall be packed in each shipping container.

C. MARKING

Each packing and/or shipping container shall be durably and legibly marked with the following information:

1. Name of item
2. Serial number(s)
3. Quantity
4. Contract number
5. Gross weight of container
6. Manufacturer’s name
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DIVISION 6: AERONAUTICAL GROUND LIGHTING AND CONTROL SYSTEM

1.1 GENERAL

Work shall consist of furnishing all labor, equipment, tools, materials and related services necessary for the installation of complete Airfield Lighting System (hereinafter AFLS) of Laguindingan Airport as required by the specification and as shown on the drawings, subject to the General Terms and Conditions of the Contract and Special Conditions of the Contract. The work also includes the completion of those details of AFLS not mentioned or shown which are necessary for successful operation of AFLS.

Furnishing all Airfield Lighting facilities conform to up-dated ICAO and FAA standards, also all facilities functions are more than above

Even if there are no notes, general standards documented hereafter shall conform to the latest standards in order to guarantee the quality of this work and materials. In addition, if a standard is acted recently, the standard shall be applied. All the products and materials used for this work shall be performed as same class or over according to general standards.

1.1.1 Scope of Works

The Work included in this Division is the supply, installation, testing and commissioning of the Aeronautical Ground Lighting and Control System complete in all respect and in accordance with the requirements of the Specifications.

1.1.2 Submittals

1) Shop drawings

   a) Contractor shall design shop drawings for following cases. Contractor shall be responsible for designed items shown on shop drawing and shall have liability to construct designed items in accordance with approved shop drawings. Contractor also shall construct after receiving approval document from the Owner’s Representative for the submitted shop drawing.

      (1) Any parts to be constructed differ from Approved drawings.

      (2) Any items to be constructed not shown on Approved drawing.

   b) Though shop drawing is designed to meet field condition or to supplement any deficiency of approved drawing, Contractor shall design shop drawing in accordance with basic design criteria which are shown on approved drawing and specification.
Following items shall be shown on the shop drawings, but not limited to:

1) Measured dimensions
2) Material specification to be applied to
3) Construction specification, if necessary,
4) Applicable standard or design criteria.

2) Product data

Contractor shall include following data in manufacturer’s product data and shall submit product data or product options and substitutions for approval of the Owner’s Representative.

a) Technical data

Mechanical and electrical data for each component and complete unit shall be included.

3) Manufacturer’s Instructions

Following instructions shall be included in manufacturer’s instructions.

a) Installation Notes

Installation notes and notes on adjustment shall be included.

b) Maintenance

Safety precautions and defect rectification shall be included.

c) Specific requirements for application condition, if any.

4) Test Report

Tests for product or materials shall be carried out by contractor in accordance with Standards specified in related Sections and test report with test certificate shall be submitted for approval of the Owner’s Representative.
1.1.3 Quality Assurance

1) General

The Contractor shall establish, document and implement a quality assurance program to ensure that delivered items conform to the requirements of the contract including a quality assurance requirements of this paragraph, and also contractor shall submit the controlled copies of its quality assurance program for the review and comment of the Owner’s Representative in accordance with the submittal requirements.

a) Quality Assurance Criteria

The following Quality Assurance Criteria identify the minimum essential elements of a quality assurance program.

(1) Organization

The responsibility and authority of person organizations performing activities affecting quality shall be clearly established and documented in the program. Quality shall also be attained by all person organization responsible for performing the work or activities to which the program applies.

(2) Quality Assurance Program

The quality assurance program shall be established to assure that adequate design criteria are specified and complied to enhance the availability and reliability of the items covered in the subsequent technical specifications. The followings shall be adhered to as applicable.

(a) Design Control
(b) Document Control
(c) Procurement Control
(d) Materials Equipment Control
(e) Control of Special process
(f) Inspection and Test Control
(g) Nonconforming Control
(h) Quality Assurance Records
(i) Audits
2) Qualification

Personal performing or managing activities affecting quality shall be indoctrinated or trained to assure that suitable proficiency of these personnel is achieved and maintained. Following items of personnel reports affecting quality shall be reviewed to assure quality.

a) Identification of personnel to be indoctrinated or trained.
b) Records of personnel training and indoctrination or qualification.
c) Qualification and certification of personnel performing special process.

3) Compliance with Requirement

The Contractor shall design, manufacture, test, installed and commissioned in accordance with requirements of the References in subsequent technical specifications so as to maintain quality as best.

1.1.4 Sequencing and Scheduling

1) Coordinate electrical equipment installation with other building components.

2) Arrange for chases, slots and openings in building structure during progress of construction to allow for electrical installations.

3) Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

4) Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work. Coordinate installing large equipment requiring positioning prior to closing in the building.

5) Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

6) Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
1.1.5  Maintenance and Operation Manual

1) Preventive Maintenance Plan and Schedule

The Contractor shall develop a preventive maintenance plan for electrical equipment and associated systems development and implemented by Contractor.

The plan shall include tool and spare parts. Contractor shall provide complete detailed as to maintenance personnel resource and skill level requirements support electrical equipment and associated systems.

2) Corrective Maintenance Plan

The Contractor shall develop a corrective maintenance plan for electrical equipment and associated systems development and implemented by the Contractor.

The plan shall include tool and spare parts. Contractor shall provide complete detailed as to maintenance personnel resource and skill level requirements support electrical equipment and associated systems.

3) Operation and Maintenance Manual

The Contractor shall address, but not be limited to, such fundamental operational issues as:

(1) Background and objectives,
(2) Operational environments,
(3) Capabilities/functions,
(4) Procedures,
(5) Performance characteristics, and
(6) Provisions for continuity of operations in emergency operations.
(7) The maintenance philosophy
(8) Maintenance roles and responsibilities,
(9) The maintenance workforce qualifications and requirements, and
(10) Development of maintenance management requirements such as remote maintenance monitoring and control, functional system documentation, and diagnostic systems, preventive and corrective maintenance methods and systems.
1.2 PRECISION APPROACH LIGHTING SYSTEM (PALS) FOR RUNWAY 27

1.2.1 System Description

1) The PALS shall be in compliance with ICAO Annex14, Volume 1, para 5.3 and 5.3.4, for use in CAT-1.

2) Center line barrette lights shall be placed at longitudinal intervals of 30m on the extended center line of the runway extending over a distance of 720m from the threshold.

3) Crossbar lights shall be placed at 300m from the threshold in a horizontal straight line at right angles to, and bisected by, the line of the centerline lights.

4) Capacitor discharge lights shall be added to each center line barrette except from first barrette to 9th barrette.

5) Center line barrette and crossbar lights shall be fixed lights showing variable white.

6) Capacitor discharge light shall be able to flash twice a second in sequence showing white, beginning with the outermost light and progressing toward the threshold to the innermost light of the system.

1.2.2 Material

1) Elevated approach centerline & cross bar lights

   a) The elevated unidirectional approach and cross bar high intensity lights shall be in compliance with ICAO Annex14, Volume 1, for use in CAT-1

   b) The light unit shall meet approach centerline and cross bar photometric specifications with a lamp of 150W.

   c) The expected life of lamps shall be not less than 1,000 hours at full intensity.

   d) Specifications are all conform to FAA AC 150/5345-46D

   e) Type: For central line barrette and crossbar lights; high intensity; unidirectional; single 6.6amp, 150 watt; and light intensity distribution as follows:

      (1) Minimum average intensity shall be 20,000 candelas in area of 20 degrees in horizontal and 11 degrees in vertical.(ICAO Annex14, fig A2-1).

   f) The design and construction shall conform to the main mechanical requirements of FAA AC150/5345-46D.
g) Each fitting for center line lights and crossbar lights shall consist of:

1. Optical head of aluminum alloy casting
2. Spun anodized aluminum parabolic reflector.
3. Heat resistant spreader glass lens.
4. Pre-focus type lamp-holder or a sealed lamp requiring no focusing at time of installation or at servicing.
5. Grounding terminal.

h) Each fitting for center line lights and crossbar lights shall be light weight, suitable for ground mounting and allow adjustment of the beam in vertical between 0 and 30 degrees / from the horizontal.

i) Cable
As specified under Section 6.16: 5,000 Volt.

j) Isolating Transformer
As specified under Section 6.16: 150 Watt

2) Inset approach centerline lights

a) The inset approach centerline lights shall be in compliance with ICAO Annex 14, Vol.1, para. 5.3.4 and the mechanical requirements of FAA AC 150/5345-46D for use as approach light in CAT-1

b) Specifications of Inset approach centerline lights are conform to FAA AC 150/5345-46D

c) The inset approach centerline lights, 105W x 3EA lamp shall meet photometric specifications.

d) Minimum average intensity shall be 20,000 candelas in area of 20 degrees in horizontal and 11 degrees in vertical. (ICAO Annex 14, fig A2-1)

e) The expected life of lamps shall be not less than 1,000 hours at full intensity.

f) The projection above ground level shall not exceed 12.7mm.

g) Major parts of the light shall be made from aluminum alloy. All parts, including hardware shall be user-replaceable without making use of sealing components.

h) Cable
As specified under Section 1.16: 5,000 Volt

i) Isolating Transformer
As specified under Section 1.16: 300 Watt or 100 Watt.
3) Sequenced flashing lights

a) The sequenced flashing light shall be in compliance with ICAO Annex 14, Vol. 1, para 5.3.4 and in compliance with FAA AC 150/5345-51A and E-2628 specifications.

b) They shall use a Xenon discharge tube having an expected minimum life of 500 hours at the highest energy level.

c) The light performance shall comply with ICAO and FAA requirements.

d) Each light fitting will be connected to its control cabinet through a dedicated communication cable.

e) Each unit for capacitor discharge lights shall consist of light fitting, power unit and control cabinet unit as follows

(1) Lighting fitting
   (a) Aluminum alloy housing
   (b) Reinforced front glass with not less than 3mm thickness
   (c) DC 5000V 41 Joule Xenon discharge lamp
   (d) Electrolytic anodized, anodic oxidized aluminum reflector
   (e) Lead cable
   (f) Elevation angle of beam axis shall be adjustable by 2-degree from 0 to 15 degrees
      The elevation angle adjuster shall be provided for leveling correction.

(2) Power unit (Power supply)
   The power supply provides power and triggering pulses to the optical head.
   (a) Rigidly constructed aluminum alloy plate of not less than 2.0mm thick water proof type housing.
   (b) Door with handle.
   (c) Flashing circuit unit.
   (d) Door interlock switch.
   (e) Lighting arrested.

(3) Control cabinet.
   (a) The control cabinets shall operate properly at any input voltage ranging from 190 to 253V, 50Hz or from 200V to 268V, 60Hz without need for adjustment taps.
   (b) Output voltage : Single phase 360v 50/60Hz
(c) Intensity control: 3 level (Low, Medium, High)
(d) Lamp status monitoring

1.2.3 Installation

1) As shown in the Drawings, elevated type light fittings shall be installed on the top of the galvanized steel pipe (under 1.8m) and fiberglass reinforced plastics (above 1.8m), which is to be fitted to the normal bend housed in the concrete base.

2) Inset type light fitting shall be installed in the base box. In elevation, the axis of the beams of the high intensity approach lights shall be set as follows:

   Approach Centerline and Cross-bars
   Threshold to 315m: 5.5 degrees
   316 to 475m: 6.0 degrees
   476 to 640m: 7.0 degrees
   641 to 900m: 8.0 degrees

   The high intensity approach lights shall be install as accurately as practicable but in no case shall be error be greater than ±0.25 degree.

   Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site.

3) Approach Lighting System foundations are provided by DOTC (Elevated type).

4) ALS lower foundations are provided by DOTC (Inset type).

1.3 SIMPLE APPROACH LIGHTING SYSTEM (SALS) FOR RUNWAY 09

1.3.1 System Description

1) Centerline barrette lights shall be placed at longitudinal intervals of 60m on the extended center line of the runway extending over a distance of 420m from the threshold.

2) Crossbar lights shall be placed at 300m from the threshold, as nearly as practicable in horizontal straight line at right angles to, and bisected by, the line of the center line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 18m is used, gaps may be left on each side of the center line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6m.

3) Center line barrette and crossbar light shall be fixed lights and the color of the lights shall be such as to ensure that the system is readily distinguishable form other aeronautical ground lights, and from extraneous lighting if present.

4) Approach lighting system shall be controlled in five brilliancy stage of 100 percent, 25 percent, 5 percent, 1 percent and 0.2 percent of full brilliancy.
1.3.2 Material

1) Elevated approach centerline & cross bar lights
   The same as 1.2.2, para 1)

2) Sequenced flashing lights
   The same as 1.2.2, para 3)

1.3.3 Installation

1) As shown in the Drawings, elevated type light fittings shall be installed on the
   mounting base.

2) Exact position of light fittings to be installed shall be subject to the approval of the
   Engineer at the site.

1.3.4 Mounting Base

1) The mounting base shall contain the transformer box.

2) The mounting base shall be so erected as to be capable of supporting the light
   fitting horizontally balanced within a tolerance of ±2% gradient.

3) Approach lighting system foundations are provided by DOTC (Elevated type).

1.4 PRECISION APPROACH PATH INDICATOR (PAPI) FOR RUNWAY 27 AND 09

1.4.1 System Description

1.4.1.1 The PAPI unit will meet or exceed the performance specified by ICAO, Annex 14, Vol. 1
   para. 5.3.5.23 to 5.3.5.45 and will be in compliance with FAA AC 150/5345-28F and FAA
   L-880 specification. The average intensity in red light will be at least 15,000 Cd for a
   horizontal beam spread -6˚ to +6 and a vertical angle of 3.5˚below transition.

   The transition band must be flat within 3 minutes of arc.

1.4.1.2 The Precision Approach Path Indicator (PAPI) systems shall consist of wing bar of four (4)
   sharp transition multi-lamps equally spaced. The system shall be located on the Pilot and
   Co-pilot side of the Runway.

1.4.1.3 The wing bar of PAPI shall be constructed and arranged in such a manner that a pilot
   making an approach will:

   When on or close to the approach slope, see the two units nearest the runway as RED and
   the two units farthest from the runway as WHITE; and when further above the approach
   slope, see all the units as white; and

   When above the approach slope, see the one unit nearest the runway as RED and the three
units farthest from the runway as white; and when further above the approach slope, see all the units as white; and

When below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red.

The PAPI system shall be controlled in five (5) brilliancy stage of 100 percent, 25 percent, 5 percent, 1 percent and 0.2 percent of full brilliancy.

1.4.2 Material

1) Each light unit must have at least two lamps.
2) The expected life of the lamps will be not less than 1,000 hours at full intensity.
3) The optical system for each light channel will consist of high purity aluminum reflector, a red, through-colored glass filter and two lenses made of optical glass. Lamps and filters will be easily replaceable without need of re-calibration.
4) The PAPI unit will be mounted on four legs fitted with precision elevation adjustment. The unit will be made from folded aluminum sheet fully protected against corrosion. It will be fully weatherproof.
5) A hardened glass will be provided in front of lenses to protest them against sandblast
6) The light unit must use a protective overhang or other method to prevent rain from accumulating on its lens surfaces.
7) A set of installation tools and calibration instruments will be supplied with each system.
8) Cable
   As specified under Section 1.16: 5,000 Volt.
9) Isolating Transformer
   As specified under section 1.16: 200 Watt.

1.4.3 Installation

1) Each light unit shall be installed on a concrete base using a frangible coupling as shown in the Drawing.
2) A light unit may not be higher than 40 inches (1 meter) at its maximum height when installed at its minimum mounting height.
3) To ensure that units are mounted as low as possible and to allow for any transverse slop. Small height adjustments of up to 5 cm between units are acceptable.
4) Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site.
1.5 RUNWAY THRESHOLD IDENTIFICATION LIGHTS (RTIL)

1.5.1 System Description

1) Runway threshold identification lights shall be in compliance with ICAO Annex 14, Vol.1, para 5.3.8.2 and in compliance with FAA AC 150/5345-51A and FAA L-849 specification.

2) Runway threshold identification lights shall be located symmetrically about the runway center line, in line with the threshold and approximately 10m outside each line of runway edge lights.

3) Runway threshold identification lights should be flashing white lights with a flash frequency between 60 and 120 per minute.

4) Runway threshold identification light system shall be controlled at CCR room in power house.

1.5.2 Material

1) The requirement of component
   a) The optical assembly consists of an optical head and a power supply
   b) The strobe unit shall be composed of photometric system and photometric case with solid water resistance structure.
   c) The power supply case with solid water resistance structure
   d) The power supply unit and strobe unit shall have a distance of 45cm at most in the separated case and be able to be used sequence.

2) The strobe unit
   It shall be composed of light source, refractor, front glass and lamp holder
   a) The discharge lamp of light source shall be made of fitting Xenon photometric character, and satisfied with photometric character, and its life shall be 1,000h at least.
   b) Reflector
      (1) The reflector shall be made of high degree of purity aluminum, 99.85% shaped enough to go off the beam as defined in 6.5.2.1.
      (2) Its thickness shall be 1.0mm at least.
      (3) The rate of reflection shall be 80% at least without the harmful defect in using.
c) Front glass

(1) The thickness of front glass is 3mm at least.

(2) The lamp supporter used for discharge tube shall be made of magnetic material. The lamp supporter used for relay shall be made of magnetic material or phenol resin. These lamp supporters, molded type shall be excel in endurance.

(3) Aiming

(a) The optical head shall be adjustable vertically from 0 to 15 degrees and horizon totally 15 degrees each side of a zero reference point. Aiming reference scales shall be graduated in a maximum of one degree increments.

(b) A positive locking device shall be provided to prevent accidental movement of the optical head after aiming.

3) Power supply

The power supply provides power and triggering pulses to the optical head.

a) It shall be composed of proper parts in order that the optical head satisfies with requirement.

b) Power supply case

(1) This case shall be rigid watertight structure and not be changed by transference, installation, mending.

(2) This case shall be able to be installed on the horizontal base.

(3) The door shall be installed in this case to be examined and mended.

(4) The terminal for grounding is installed in proper place of this case.

4) Marking and packing

a) Nameplate

The metal nameplate which has contents as following shall be installed on the body.

(1) Name of unit (optical head, power supply, etc)

(2) Manufacture name and address.

(3) Manufacture’s part number

b) Packing

The quality of packing material shall be good so that withstand the transferring and handling.
1.5.3 Installation

1) Elevated type light fittings shall be installed on the mounting base.
2) Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site.
3) Installation equipment, components and accessories per manufacturer’s instructions; and per shop drawings as approved.

1.6 RUNWAY EDGE LIGHTS

1.6.1 System Description

1) The Runway Edge Light shall be high intensity, elevated, in full compliance with FAA L-862 specification (FAA AC 150/5345-46D and 150/5340-30D) and with ICAO Annex, Vol. 1, para 5.3.9 for use in Category 1.

The Runway Edge High Inset Light shall be in compliance with ICAO Annex 14, Vol. 1, para 5.3.9 and FAA L-850 and FAA AC 150/5345-46D for use in Category 1. Include the other relevant FAA Specifications.

2) High intensity bi-directional light fittings placed along both edges of runway, over entire length of 2,000 meters, and placed uniformly at not more than 60 meter intervals.

3) Light fittings for a distance of 600 meters from both thresholds shall be equipped with aviation yellow filters to show color only at remote end of runway; with all other light fittings showing clear when viewed from approaching aircraft.

4) Runway Edge lighting system shall be controlled in five brilliancy stages of 100 percent, 25 percent, 5 percent, 1 percent, and 0.2 percent of full brilliance.

5) Runway Edge Lights shall be placed along the full length of the runway and shall be in two parallel rows equidistant from runway centerline.

6) Runway Edge Lights shall be placed along the edge of the area declared for use as the runway or outside the edges of the area of a distance of not more than three (3) meters.

1.6.2 Material

1) Photometric body
   a) Construction of Photometric body
      (1) Optical body shall consist of lamp, lens, filters and lamp socket.
(2) Components of optical body shall be fabricated in a manner of easy change and check.

(3) It shall be protected from dust, corrosion, ingress of humidity and other adverse environmental effect.

b) Lamp

(1) High intensity halogen lamp

(2) Rating: 6.6A

(3) Life time: More than 1,000hrs

c) Lens

(1) The lens shall be thermal resistant glass or equivalent and shall satisfy test requirements specified in FAA AC 150/5345-46D.

(2) The lens shall be finished without scratch in process of cutting treatment.

(3) The groove shall be made to fix the direction of lens regularly in the suitable place.

(4) The lens shall have the suitable marker to indicate the runway direction.

d) Filter

The filter shall be made of the equal or more than thermal resistance glass.

e) Lamp Holder

(1) Lamp holder shall be fixed that have the center of lamp light focused on the lens.

(2) It shall be designed for easy replacement of lamp and shall not cause the displacement of lamp during operation.

f) Shield

(1) The shield shall be installed to restrict the light that flash on the runway direction.

(2) The shield shall not have bending cracks because of the high temperature of the lamp inside the light.

2) The body of light

a) Composition

The body of light would be composed of upper part and lower parts made of aluminum alloy.
The standard installed height of elevated light fixture not exceed 14 inches (355mm) from the ground level.

b) The upper parts

(1) The lens, filter should be installed in the upper part.

(2) The upper parts should be structured of no need for adjustment and alignment after replacement of lamp.

(3) Thermal resistance materials that have proper thickness shall be put into between lens and the upper part so as to protect the bottle of lens and to keep waterproof characteristics.

c) The lower parts

(1) Lamp supporter shall be installed in the lower part.

(2) The lower part shall be controlled at any angle within vertical 4º vertical by using the adjustable device and fixed at random angle by using screws or others.

3) Mechanical Parts

a) Bolt, Nut and Washer

The material of bolt, nut and washer shall be more than STS 304 except for conductor part.

b) Metal Parts

(1) The quality of metal shall be corrosion resistance materials. In case of using the metal it should be coated to prove its corrosion resistance.

(2) In case of using a metal, which may cause electrolytic etching by contacting with other type of metal, it shall be coated or shall be used any other method for protecting.

(3) It shall be considered non-abrasion and heat-resistance according to the site condition when surface coating would be required.

c) Coupling

The coupling shall have the dimension fitted in the lower parts and the fragile character in applying static load at most 230kg over the top of coupling.
4) Electrical Parts

a) Terminal board (In-pavement type)

(1) The terminal block connector shall be made of the copper of conductivity of 90% or more.

(2) The terminal board shall be fixed on the body of light firmly by using of stainless steel bolt and nut.

b) Leads

(1) The material of leads from terminal block shall be at least EP rubber chloroprene flexible cable class2, 1.25mm² X 2C or equivalent. The length of the leads shall be adequate to extend from the unit through a flexible conduit to a frangible coupling at ground level.

(2) System shall have suitable plugs to connect terminal plate and the one end of the cable, mating surface of the other end of cable and of the lead of the isolation transformer.

(3) Where the lead is fed from the light body, rubber bushing or suitable protection device for leads shall be provided. And though the external forces stress on the leads, any force through leads shall not be affected to terminal board and connection.

(4) The material of leads from lamp to terminal block shall be more than 600V single 1.25 mm², and it shall be connected to the terminal board. (inset type)

5) Others

a) Coating and painting

The color of light unit surface should be aviation orange or yellow. (Elevated type)

The material of coating and painting shall not cause any discoloration.

b) After the adjustment of fabrication, the bolt and nut shall be fixed by use of enamel.

c) Marking and packing

(1) Nameplate

The metal nameplate which has contents as following shall be installed on the body.
(a) Type, the name of product

(b) Manufacture date and number

(c) Manufacturer’s name

(2) Packaging
The quality of packing material shall be good so as to withstand the transportation and handling.

d) Cable
As specified under Section 1.16: 5,000 volt.

e) Isolating Transformer
As specified under Section 1.16: 100 or 150 Watt. (Elevated type)
200W (Inset type)

1.6.3 Installation

1) Elevated type light fitting shall be installed on base box using a frangible coupling as shown in the Drawing at a distance of 1.5m from the runway edge.

2) Inset type light fitting shall be installed in the pavement as shown in the Drawing at a distance of 1.5m from the runway edge.

3) The projection above ground level shall not exceed 12.7mm. (Inset type).

4) Installation equipment, components and accessories per manufacturer’s instructions; and per shop drawings as approved.

5) REDL lower foundations are provided DOTC (Inset and Elevated type).

1.7 RUNWAY END LIGHTS

1.7.1 System Description

1) The Runway End High Intensity Inset Light shall be in compliance with ICAO Annex 14, Vol. 1, para 5.3.11 and FAA L-850 D as per AC 150/5345-46D. Include the other relevant FAA specifications.

2) Runway end lights shall consist of six (6) high-intensity inset type light fittings for Runway 27 and 09 and shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3m outside the end.

3) Runway end light shall be symmetrically disposed about the runway center line in two groups with fittings uniformly spaced in each group and with a gap between the group of not more than half the distance between the rows of runway edge lights.

4) Runway end lights shall be fixed unidirectional lights showing red in the direction of the runway.
5) Runway end lighting system shall be controlled in five brilliancy stages of 100 percent, 25 percent, 5 percent, 1 percent, and 0.2 percent of full brilliance.

1.7.2 Material

1) Light Fitting
   a) Type: Surface type, 6.6 amp, 105W, fixed unidirectional, with aviation red filter.
   b) Light intensity distribution shall be as follows:
      (1) Minimum average intensity shall be 2,500 candelas in area of 12 degrees in horizontal and 4.5 degrees in vertical.
      (2) Peak intensity shall not exceed 1.5 times actual average.
   c) Each fitting shall consist of an aluminum alloy casting optical head and outer ring with steel base junction box designed for installation in steel base and of sufficient size to house isolating transformer.

2) Cable
   As specified under section 1.16: 5,000 volt.

3) Isolating Transformer
   As specified under section 1.16: 100 watt.

1.7.3 Installation

1) Each fitting shall be installed in the base box as shown in the Drawing.

2) Transformer box shall be made of steel base.

1.8 RUNWAY THRESHOLD LIGHTS

1.8.1 System Description

1) The Threshold High Intensity Inset Light shall be in compliance with ICAO Annex 14, Vol. 1, para 5.3.10 and FAA L-850 D as for AC 150/5345-46D for use in Category 1
   Include the other relevant FAA specifications.

2) Runway threshold lighting systems shall consist of seventeen (17) high intensity inset type light fittings for Runway 27 and 09.

3) Runway threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.

4) Runway threshold lights shall be fixed unidirectional lights showing green in the direction of approach to the runway.
5) Runway edge lighting system shall be controlled in five brilliance stages of 100 percent, 25 percent, 5 percent, 1 percent, and 0.2 percent of full brilliance.

1.8.2 Material

1) Light Fitting
   a) Type: inset type: 6.6 amp, 105W x 2, fixed unidirectional, with aviation green filter.
   b) Light intensity distribution
      (1) Threshold lights
          Minimum average intensity shall be 10,000 candelas in area of 10 degrees in horizontal and 9 degrees in vertical. Peak intensity shall not exceed 1.5 times actual average.
      (2) Peak Intensity: Not less than 15,000 candelas in white.
   c) Each fitting for elevated type shall consist of:
      (1) Cast aluminum alloy housing
      (2) Span anodized aluminum parabolic reflector
      (3) Front glass
      (4) Pre-focused type lamp-holder.
   d) Each fitting for inset type shall consist of an aluminum alloy casting optical head and steel base junction box designed for installation in concrete and of sufficient size to house isolating transformer.

2) Cable
   As specified under section 1.16: 5,000 volt

3) Isolating Transformer
   As specified under section 1.16: 200 Watt

1.8.3 Installation

1) Each fitting shall be installed in the base box as shown in the Drawing.
2) Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site.
3) The projection above ground level shall not exceed 12.7mm
4) RTHL lower foundations are provided by DOTC.
1.8.4 Mounting Base

1) The mounting base shall contain the transformer box.

2) Transformer box shall be made of steel base.

1.9 TAXIWAY EDGE LIGHTS

1.9.1 System Description

1) The Taxiway Edge Low Intensity Elevated Light shall comply with FAA L-861 T specification(AC 150/5345-46D and 150/5340-30D) and with ICAO Annex 14, Vol.1, para 5.3.17.

2) Taxiway edge lighting shall consist of elevated type lights along edges of all taxiways and aprons as shown in the Drawings.

3) Additional lights shall be provided to indicate exits and entrances to and from runways and aprons as shown in the Drawings.

4) Taxiway edge lighting system shall be controlled in three brilliancy stages of 100 percent, 30percent, 10percent of full brilliance.

1.9.2 Material

1) Light Fitting

   a) Type: elevated type, 6.6 amp, 30W/45W omni-directional tungsten halogen lamp, with heat resistant aviation blue lens.

      (1) Light Distribution: Beam light intensity not less than 2 candelas in blue over a beam width of 6 degrees in a vertical plane at an elevation of 3 degrees.

      (2) Minimum Intensity : 2 candelas

   b) Each fitting shall consist of:

      (1) Cast aluminum housing

      (2) Pre-focused lamp holder

      (3) Heat resistant aviation blue colored lens

   c) Each fitting shall be weatherproof, suitable for ground mounting with frangible stem or coupling and shall have facilities for leveling optical system after installation.

2) Cable

   As specified under Section 1.16: 5,000 Volt.
3) Isolating Transformer
   As specified under Section 1.16: 30/45 Watt.

1.9.3 Installation

Each fitting shall be fitted on the base box using a frangible coupling as shown in the Drawing at a distance of 1.5m from the taxiway and apron pavement edge.

TEDL lower foundations (PCCP area) and foundations (Lawn area) are provided by DOTC.

1.9.4 Transformer Box

1) The mounting base shall contain the transformer box
2) Transformer boxes shall be made of steel base

1.10 TAXIWAY GUIDANCE SIGN

1.10.1 System Description

1) The Internally Illuminated Guidance Signs shall be in full compliance with ICAO Annex 14, Vol. 1, para 5.4 and Appendix 4.
   Also, Taxiway Guidance signs shall be in full compliance with FAA AC 150/5340-18F and 150/5345-44H.
2) Information signs shall include: direction signs, location signs, destination signs, runway exit signs and runway vacated signs.
3) Mandatory signs include no entry signs, holding position signs, and taxiway/runway intersection signs.
4) Information sign should consist of either yellow inscriptions on a black background or black inscriptions on a yellow background. When intended for use at night or during conditions of poor visibility, the sign is illuminated either internally.
5) Mandatory sign consist of an inscription in white on a red background. The sign should be rectangular with the long axis parallel to the ground. When intended for use at night or during conditions of poor visibility, the sign is illuminated either internally.
6) Runway distance remaining signs are used the provide distance remaining information to pilots during take off and landing operations. The signs have a white numeral inscription on a black background.

1.10.2 Material

1) Construction

The signs shall be constructed of lightweight, nonferrous materials and shall be designed for installation on a concrete pad or stakes. All required mounting hardware with anchor bolts, shall be supplied with the sign.
a) Sizes

The taxiway guidance signs can be categorized as described in the Table 1 depending on the types of the aircraft. According to the table, the sizes of the information signs are categorized as noted in the table 1.

(1) Inscription heights shall conform to the following tabulation

<table>
<thead>
<tr>
<th>Runway Code Number</th>
<th>Minimum Character Height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mandatory Instruction Sign</td>
</tr>
<tr>
<td></td>
<td>Runway exit and runway vacated signs</td>
</tr>
<tr>
<td>1 or 2</td>
<td>300 mm</td>
</tr>
<tr>
<td>3 or 4</td>
<td>400 mm</td>
</tr>
</tbody>
</table>

(2) Arrow dimensions shall be as follows:

Legend Height  Stroke
300 mm        48 mm
400 mm        64 mm

(3) Stroke width for single letter shall be as follows:

Legend Height  Stroke
300 mm        48 mm
400 mm        64 mm

b) Mounting Legs

Mounting legs for each sign shall have frangible points located 2 inches (51mm) or less above the concrete pad or stake. The frangible points shall withstand wind loads due to jet blasts of 322 km/h, but will break before reaching an applied static load over the legend panel of 1.3 psi (8.96 kPa).

Legend panels and panel supports shall withstand, at a minimum, that pressure at which the frangible points break.

c) Sign faces

The signs may be either single face with a message only on one side or double face with a message on two sides. Lighted sign faces shall comply with FAA 150/5345-44H.

d) Sign power

Sign shall be designed for operation from an airport series lighting circuit with a current range of 4.8 to 6.6 ampere. Signs should use an appropriate
isolation transformer with a 6.6 ampere secondary. Also, signs shall meet the luminance requirements in this section.

e) Sign luminance
Sign luminance shall be in full compliance with ICAO Annex14.

2) Materials and Components

a) All materials used in fabrication of the signs and mounting hardware shall be suitable for the signs intended propose and adequately protected against corrosion. All sign assembly hardware, including screws, bolts, nuts, washers, and latches, shall be 18-8 stainless steel. All wiring and components shall be adequately rated and shall not be operated in excess of the component manufacturer's recommended rating.

b) Colors

(1) Mandatory signs
Inscription: white
Background: red

(2) Information signs
Inscription: black
Background: yellow

3) Finish

External surfaces of the signs, excluding the mounting legs and face panel, must be low luster white finish. Paint coatings or surface treatments on nonmetallic surface must be equal in quality to those on metal surfaces. Paint coatings and surface treatments must be free from any runs, blotches and scratches.

4) Frangible Couplings

Each frangible coupling shall be permanently marked with the manufacturer name (which may be abbreviated) and size of sign for which the coupling is intended.

5) Marking and packing

a) Nameplate

The metal nameplate which has contents as following shall be installed on the body.
(1) The name of product
(2) Manufacture’s name and address
(3) Date of manufacture.
(4) Catalog number
(5) Lamp data including the lamp type and rating

b) Packaging

The quality of packaging material shall be good so as to withstand the transportation and handling.

1.10.3 Installation

1) Each fitting shall be installed in the base box as shown in the Drawing.
2) Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site

1.11 ILLUMINATED WIND DIRECTION INDICATORS

1.11.1 System Description

2) An airport is equipped with one or more wind direction indicator. If only one wind indicator is provided, it is located near the center of the runway complex.
3) It should be visible to aircraft in flight or on the movement area and installed in such a manner as to be free from the effects of air disturbances caused by nearby objects.
4) The wind direction indicator is in the form of a truncated cone made of fabric.
5) The wind indicator is lighted for night use and mounted on lightweight frangible tower when installed near a runway.

1.11.2 Material

The Wind Direction Indicator assemblies shall be composed of wind cone, wind cone framework, hinged pole, lighting fixture, supporting shaft, etc.

1) Wind Cone

a) If the fabric is not naturally immune to water absorption, it shall be treated to become water repellent.

b) The wind cone shall be in the form of a truncated cone with a minimum throat diameter of 0.9 m and overall length of 3.75m.
2) Framework

   a) A framework shall be provided to hold the throat of the fabric cone fully open under no wind conditions and an interface with the support. Bearings, bushings, or like devices shall be either permanently lubricated or provided with fittings to allow periodic lubrication.

   b) It shall be low-mass design so as to offer minimum resistance to an inadvertent strike by aircraft. The framework may be made of metallic or nonmetallic material. Ferrous materials shall be hot-dipped galvanized, zinc plated, or epoxy-resin coated to provide protection against corrosion.

3) Hinged pole

   The hinged pole supporting the wind cone and the light fixtures shall be installed on the supporting shaft using pivot or hinge to exchange the wind cone and light fixtures with lower position by bringing down the hinged pole.

4) Supporting shaft

   a) The lower part of supporting shaft shall be fixed on the concrete base. If the hinged pole is needed to bring down for repairing, a cleat shall be attached between the lower part of hinged pole and support shaft to fix the hinged pole on proper height.

5) Light Fixture

   a) The Wind cone assembles shall be supplied with sufficient light fixtures to provide a minimum of 21.5 lx illumination at any point of the horizontal plane described by complete rotation of the upper surface of a fully extended cone. Light fixtures shall be placed and aimed to minimize objectionable glare to airplane pilots.

   b) The light source, the lamp, 220V/150W×4EA (Flood Light).

6) Obstruction Light

   The obstruction light of 220V, 100W should be mounted at the highest point of the wind cone assembly to avoid being obscured by any other part when viewed from above.

7) Wiring and Pipe Arrangement

   The wiring, from the bottom of supporting shaft to the light fixture shall be received into the internal part of wind direction indicator or cable protecting pipe. Also, the power cable shall have the proper form and capacity to satisfy with the requirements of wind direction indicator.
8) Marking and Parking
   a) Nameplate
      The metal nameplate which has contents as following shall be installed on the body.
      
      (1) Type, the name of product
      (2) Manufacture date and number
      (3) Manufacture’s name
   b) Packaging
      The quality of packing material shall be good so as to withstand the transportation and handling.

1.11.3 Installation

1) The wind direction indicator should have a length of not less than 3.6m and a diameter, at the larger end, of not less than 0.9m.

2) The color or colors should be so selected as to make the wind direction indicator clearly visible and understandable from a height of at least 300m, having regard to background.

3) Where a combination of two colors is required to give adequate conspicuity against changing backgrounds, they should perfectly be orange and white, red and white, or black and white, and should be arranged in five alternate bands, the first and last bands being the darker color.

4) The location of at least one wind direction indicator should be marked by a circular band 15m in diameter and 1.2m wide. The band should be centered about the wind direction indicator support and should be a color chosen to give adequate conspicuous, preferably white.

5) Wind direction indicator light shall be located 300m from the runway end and 120m apart from the centerline opposite side of taxiway.

1.12 AERODROME BEACON LIGHT

1.12.1 System Description

1) The Aerodrome Beacon Light shall be in compliance with ICAO Annex 14, Vol. 1, para 5.3.3 and with FAA L-801(AC 150/5345-12E) specification.

2) The aerodrome beacon shall be installed on the top of the control tower.

3) The aerodrome beacon shall rotate to produce alternately white and green flashes. The frequency of total flashes shall be from 20 to 30 per minute
4) Aerodrome beacon shall be controlled at control tower and at CCR room in Main Power House.

5) Effective intensity of the flash shall be not less than 2,000 cd at location where a high ambient background lightings level effective intensity of the flash may be required to be increased by a factor up to a value of 10.

1.12.2 Material

1) Aerodrome Beacon

   a) Aerodrome beacon shall employ a regular use 1,000 watts lamp, and stand-by use lamp which shall be automatically changed into regular lamp position and lighted when regular lamp burn-out.

   b) Light Intensity Distribution

       Minimum peak intensity shall be 100,000 candelas per second I white light and 15,000 per second in green and the vertical distribution of light intensity shall be as follows;

<table>
<thead>
<tr>
<th>Elevation angle</th>
<th>Minimum effective Intensity (Candelas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(degrees)</td>
<td>White flash</td>
</tr>
<tr>
<td>1 to 2</td>
<td>25,000</td>
</tr>
<tr>
<td>2 to 8</td>
<td>50,000</td>
</tr>
<tr>
<td>8 to 10</td>
<td>25,000</td>
</tr>
<tr>
<td>10 to 15</td>
<td>5,000</td>
</tr>
<tr>
<td>15 to 20</td>
<td>1,000</td>
</tr>
</tbody>
</table>

   c) Component

       Aerodrome beacon shall consist of:

       (1) Two lamp heads (180 degree apart), clear lens, canopy, green lens, shaft assembly, brush block assembly, power cord, steel gear, mounting adapter, motor assembly, handle.

       (2) Mounted on supporting structure.

1.12.3 Installation

1) The beacon shall be mounted on the top of the control tower.

2) Exact position of light fittings to be installed shall be subject to the approval of the Engineer at the site.
1.13 APRON FLOODLIGHTS

1.13.1 System Description


2) Apron floodlights shall be mounted Rail Typed Up & Down Pole System and each pole shall carry halide lamp floodlights and sodium lamp floodlights.

3) Apron floodlights shall be installed to provide adequate illumination to all apron service areas, with a minimum of glare to pilots of aircraft in flight and on the ground and to air traffic controllers in the control tower.

4) The average illumination on aircraft stands shall be not less than 20 lux with uniformity ratio (average to minimum) of not more than 4 to 1 in horizontal and not less than 20 lux at height of 2m above the apron in relevant directions in vertical.

5) The average horizontal illumination on the apron, except where service function are taking place, shall be not less than 50 percent of the average horizontal illumination of the aircraft stands.

6) Apron floodlights shall be controlled from remote control panel at control tower and shall be switched off for maintenance work at control PNL which is installed near apron floodlighting pole.

1.13.2 Material

1) Light Fitting

a) Narrow beam halide lamp floodlight: 1,000 watt type.

   (1) Horizontal Light Distribution: Intensity not less than 900cd/1,000 lumens over beam width of 22 degrees.

   (2) Vertical Light Distribution: Intensity not less than 900cd/1,000 lumens over beam width of 7 degrees upward and 11 degrees downward, respectively from luminous axis.

   (3) Not more than 10,000cd at the point of 15 degrees upward from luminous axis.

   (4) Peak Intensity: Not less than 9,000cd/1,000 lumens.

b) Wide beam sodium lamp floodlight: 1,000 watt type.

   (1) Horizontal Light Distribution: Intensity not less than 70cd/1,000 lumens over beam width of 110 degrees.

   (2) Vertical Light Distribution: Intensity not less than 70cd/1,000 lumens.
lumens over beam width of 10 degrees upward and 35 degrees downward, respectively from luminous axis.

(3) Not more than 10,000cd at the point of 15 degrees upward from luminous axis.

(4) Peak Intensity: Not less than 700cd/1,000 lumens.

c) Narrow beam high pressure sodium lamp floodlight: 1,000 watt type.

(1) Horizontal Light Distribution: Intensity not less than 600cd/1,000 lumens over beam-width of 22 degrees.

(2) Vertical Light Distribution: Intensity not less than 600cd/1,000 lumens over beam-width of 7 degrees upward and 11 degrees downward, respectively from luminous axis.

(3) Not more than 10,000cd at the point of 15 degrees upward from luminous axis.

(4) Peak Intensity: Not less than 6,000cd/1,000 lumens.

d) Housing: Steel sheet with electrolytically polished aluminum reflector and reinforced glass for front cover.

e) All fittings shall be designed for:

(1) Pole mounting.

(2) Maximum adjustment capability in both vertical and horizontal planes to facilitate final adjustment.

(3) Withstanding high temperatures.

(4) Weatherproof.

2) Ballast

a) Stabilized Voltage/Current maintaining by usage of automatic coiling machine.

b) Maintain defect tolerance +2% by computerized automatic inspection and all lamp maintain same color rendering.

3) Apron Floodlight Pole

a) Apron floodlighting pole shall be approximately 20 meter high above the ground level.

b) Poles shall be made of steel and hot dipped galvanized uniformly.

c) All poles shall be provided with carriage to carry apron floodlights and ballast and a lightning rod mounted on the top grounded.
4) Distribution Panel of Apron Floodlights
   a) This panel shall be installed near the apron floodlighting pole and be used for supplying 3 phase 3W 220 V to apron floodlights and obstruction lights.
   b) Distribution panel shall be the weatherproof outdoor type comprising a steel sheet housing with the thickness specified in the drawing, molded case circuit breakers for controlling “ON-OFF” each circuit and terminal boards.

5) Cable
   As specified under Section 1.16.

1.13.3 Installation

1) Prior to erecting the concrete base, the Contractor shall place temporary markings to identify the actual installation positions of the light poles determined by him through detailed site survey, against the corresponding positions indicated in the Drawings, and shall notify the Engineer accordingly.

2) The Contractor shall submit the drawings of the supporting structure mounting base and its structural calculations to the Engineer before commencing the structure.

3) All poles and accessories shall be hot dipped galvanized uniformly. A lightning rod shall be provided at the top of pole and grounded. All poles shall be finished with two (2) undercoats and two (2) finish coats paint before erection or installation on the Site. The paint color for the pole shall be approved by the Engineer.

1.13.4 Mounting Base

Mounting base of the pole shall be erected underground of concrete and shall be of adequate size to support the weight of pole, light fixtures, and lighting tower control board, etc.

1.14 OBSTACLE LIGHT

1.14.1 System Description

1) The Obstruction Lights shall be low intensity, omni-directional, red in compliance with ICAO Annex 14, Vol. 1, para 6.3.11 and FAA L-810 class 1 specification.

2) Obstruction lights shall be of red steady-burning light and shall be installed on the top of the apron floodlighting poles and illuminated wind direction indicators as shown in the Drawing
3) Obstruction lighting system shall be controlled at control tower and at CCR room in Main Power House.

1.14.2 Material

1) Light Fitting
   a) Type: Omni-directional, low-intensity having aviation red light distribution of an intensity of not less than 10 candelas (red) over beam width of 10 degrees in vertical.
   b) Fitting shall consist of 220V LEB Lamp of aviation red.

2) Cable
   As specified under Section 1.16.

1.15 DISTRIBUTION AND CONTROL SYSTEM

1.15.1 Logical Control System

1) General
   a) Logical Control System follows ICAO Annex 14 recommendations.
   b) The remote control and monitoring system shall comprise a system for control of the airfield lighting system.
   c) Remote operation of the airfield lighting system shall be carried out from the Remote Touch – screen Monitor in the control tower and the Local Maintenance P.C(touch-screen) at CCR room in Main Power House.
   d) Changeover switch for operating position between Remote Touch-screen Monitor and Local Touch-screen Monitor shall be furnished at Local Touch-screen Monitor.
   e) In order to receive and / or transfer the control and monitoring signal between the monitors and facilities, PLC Panel shall be installed at CCR room in Main Power house.
   f) DC 48V or 24V shall be used as control power source between PLC Panel and Remote Maintenance P.C, Constant Current Regulators and other control equipment, except for the case between PLC Panel and Local Maintenance P.C(touch-screen) having electronic interface circuits.
   g) DC 48V shall be supplied by DC power supply board with battery and charger.
   h) Full automatic brilliancy control is desirable but not essential.
2) Components of Logical Control System

Logical control system shall compose of following equipment:

a) 1 – Remote Touch – screen Monitor (P.C)
b) 1 – Local Touch – screen Monitor (P.C)
c) 1 – PLC Panel

1.15.2 PLC PNL

1) General

a) PLC PNL connect Touch Screen(HMI equipment) and DIO(Digital input & output) attached to CCR, and send the commands to DIO according to Touch Screen operation, and has function of MCU(Main Control Unit) to send the receiving data of the state of CCR operation from DIO to Touch Screen.

b) The communication connection between PLC and Touch Screen is applied by RS485 series communication method, and Dual line composition so that assure the reliability of communication in case of improper operation of module or line.

c) The communication between PLC PNL and DIO module is used profi - bus.

d) PLC PNL is carried with Rack of the Touch Screen in the maintenance room and supplied the power through UPS.

e) PLC PNL as main control unit, has CPU, Memory card, data way control card inside, and by performing in/output, operation, control loop, link operation, it can be economical, efficient operation, which can make High speed Sequence control. Through communication card, manpower reduction can be done with best management.

f) It is possible to compose the best system for the control object by controller in PLC PNL, which can control high speed sequence. In case of problem in hardware or Software of Main Processor, compose REDUNDANCY to keep automatic operation.

2) Function

The main function of PLC PNL is as follows.

a) To remote control CCR by transferring the command to DIO attached to CCR and performing the command from Touch Screen using series communication with Touch Screen.

b) To monitor Touch Screen by sending the data to Touch Screen, and
receive the data related with CCR states from DIO of CCR by series communication.

c) To compose to make a series control of airport lighting as Dual PLC by swift to support PLC in case PLC’s unusual operation. After restoration of PLC PNL, automatically controlled by main PLC.

d) To compose PLC PNL with exclusive use communication line, make it possible to share each other. By this composed PLC PNL can have continue control of Airport lighting.

e) The control power for PLC PNL is applied with SMPS assuring reliable system operation.

f) The memory part of PLC CPU can perform continually remembering the last command by using extra storage battery in case of sudden power failure.

g) In case of improper operation of main PLC, by Dual PLC PNL, swift to support PLC, the continual control of Airport lighting is possible.

h) PLC PNL connected with Touch Screen is Multi-connection using RS-485 dual line, and design to have CheckSum Byte communication protocol.

i) All operation is based on real-time.

1.15.3 Touch Screen PNL (P.C)

It is the interface equipment for remote control and monitor of airport lightings by operator.

1) General

a) Touch screen shall be installed in Control tower and maintenance room.

b) LCD Touch screen, mouse, keyboard, speaker and printer are installed in Control Tower.

c) Maintenance room contains computer, LCD Panel, Communication Modem, UPS are installed in standard Rack.

d) The distance from computer in maintenance room to the equipment in control tower is less 10m. If necessary, amplifier and distributor are used for stable and safe operation.

e) The lines for two sections are designed to be protected from EMI.

f) The connection between the Touch Screen in the maintenance room and PLC connected with touch screen is Multi-connection by profit-bus.

g) The power supplying to touch screen operating equipment is separate power, and for continue operating in case of sudden power failure, use UPS.

h) Utilize visible and audible display for monitoring the status of control.
i) Operation of the program is basically by LCD touch screen.

j) The priority of operation of the Touch Screen placed in maintenance room is the Touch Screen placed in Control Tower, and it can be by the Touch Screen in the maintenance room in case of maintenance.

2) Program of remote control and monitor

   a) The OS for Touch screen is based on WINDOWS, and compatible with other types of computer.

   b) The remote control of Airport lighting is for CCR’s ON/OFF, step of output current and display real-time status of operation.

   c) The remote monitor of Airport lighting is for CCR’s ON/OFF, display real-time status of output of Voltage/current and CCR’s warning.

   d) Display of remote control and monitor is by CCR unit, is to be grasped at once by Runway shaped graphic.

   e) The remote control method in controlling logic is divided with DAY and NIGHT for controlling CCR according to the view range. And this controlling logic can be changed by operator.

   f) In this remote control and monitor program, it is possible to manage, do arithmetic and control all types of system, composing data and history data. In case of history data, it can be linked with MS EXELL.

   g) The operation of control-composing and display form is used by ICON or window tool box.

   h) All operation is based on real-time.

   i) Possible to input/edit of each control variable data.

   j) Operate without extra creation of control variable data in case of re-install of program.

   k) Use dialogue window for double check of confirmation to the sensitive matters such as ON/OFF of program, create/change control variable.

   l) Data base can be setup by recording of consumption of Airport lighting operation, searching the data by a certain period is also possible.

   m) The operation information of touch screen is automatically shared in case of checking the equipment or not possible to store the data.

1.15.4 Board with Batteries

   1) The board shall be installed at CCR room in Main Power House and used for supplying DC 48V to control circuits.

   2) Battery capacity shall be designed to keep not less than 90V for More than 30 minutes at 10A output.
1.15.5 Constant Current Regulator (CCR)

1) General

a) The Constant Current Regulator shall comply with ICAO Aerodrome Design Manual Part 5, para 3.2.1.4 to 3.2.1.6 and FAA AC 150/5345-10E.

b) Constant Current Regulators shall be installed at CCR room in Main Power House.

c) CCRs shall be fixed on horizontally balanced base of channel with steel anchor bolted to the floor, in such a manner that the front side of all CCRs shall be in one vertical plane.

d) CCRs shall be of Thyristor type controlled by semi-conductive controlling circuit.

e) CCRs shall contain the multiplex remote control and back indication systems hardware.

f) CCR for Airport shall consist of the control field and transformer field. Control field shall comprise plug-in units, such as CCR, Lamp Failure Indication, Insulation tester and control units. Transformer field shall accommodate the transformer modules required for the operation of the CCR in a series system as well as power incoming switch units.

2) Standard Ratings

a) Output Current: 6.6A or 20A

b) Brightness step: 3 brightness step or 5 brightness step

c) Ratings

Standard rating is shown table 1 and other voltages and frequencies may be used to suit local site conditions;

Table 1. Rating

<table>
<thead>
<tr>
<th>Standard size (kw)</th>
<th>Standard volts (volts in)</th>
<th>Standard Frequency (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4, 7.5, 10, 15, 20, 25, 30</td>
<td>220V, 380V</td>
<td>60</td>
</tr>
</tbody>
</table>

3) Performance Requirements

a) Control performance

(1) Resistive Loading

The Regulator shall maintain the output current within the limits of Table 2 while powering any load between no load (short circuit) and full load.
Table 2. Output Current (amperes rms)

<table>
<thead>
<tr>
<th>Class</th>
<th>Step</th>
<th>Nominal output</th>
<th>Allowable range</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>6.6</td>
<td>6.40 ~ 6.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5.5</td>
<td>5.33 ~ 5.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>4.8</td>
<td>4.66 ~ 4.94</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>6.6</td>
<td>6.40 ~ 6.70</td>
<td>6.6A</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5.2</td>
<td>5.04 ~ 5.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.1</td>
<td>3.98 ~ 4.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.4</td>
<td>3.30 ~ 3.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2.8</td>
<td>2.72 ~ 2.88</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>20.0</td>
<td>19.40 ~ 20.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>15.8</td>
<td>15.33 ~ 16.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>12.4</td>
<td>12.03 ~ 12.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10.3</td>
<td>9.99 ~ 10.61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8.5</td>
<td>8.24 ~ 8.76</td>
<td></td>
</tr>
</tbody>
</table>

(2) Reactive load

The CCR output current must be per Table 2 for all current steps when the CCR is connected series isolation transformers with between 0 and 30 percent of the secondary windings open circuited.

b) Efficiency

The efficiency of the regulator operated with rated input voltage into a full load having unity power factor shall be not less than the value shown in Table 3.

The power factor of load shall be 100%.

Table 3. Efficiency

<table>
<thead>
<tr>
<th>Regulator size (kw)</th>
<th>Minimum overall efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>90</td>
</tr>
<tr>
<td>More than 30</td>
<td>92</td>
</tr>
</tbody>
</table>

c) Power Factor

The power factor for regulators shall be not less than 90 percent. The power factor shall be measured with the regulator operating on the maximum intensity setting, at rated input voltage, and into a rated load with unity power factor.

d) Input Voltage

Input voltage shall be single phase, 60Hz AC.
c) Control System

The control system shall stabilize the output current at any selected intensity within 5 seconds, and shall hold the output current stable within ±0.1A ampere. The control system shall provide both local and remote control. The regulator shall function properly while operated by a circuit with a round-trip length of 3000m using 0.75mm² control cable.

f) Output Current Surge Limitation

The regulator shall be designed so that switching the regulator on and off, changing brightness steps, or shorting the load will not produce output surges that will damage series lamps.

g) Open circuit voltage

The output open-circuit voltage shall be below 140% of rated voltage when regulator open-circuit during operating at rated input voltage.

h) Protective Devices

(1) Open-circuit protection

The regulator shall include an open-circuit protective device to protect the damage by open-circuit. The device shall open the primary switch within 25/60Hz and indicate the operation status and install the external terminal after opening the output-circuit and install the external terminal.

(2) Over current Protection

The device shall open the primary switch within 2 seconds when the output current exceeds the 100% current by 5%, and within 1 second when the output current exceeds the 100% current by 10% and indicate the operation status and install the external terminal.

i) Input power loss

In the event of a loss of input power, the regulator shall resume operation on the selected brightness setting within 5 seconds after the restoration of input power.

4) Detail Requirements

a) Primary Switch

The regulator shall have a primary switching device which interrupts the input power before it reaches the main transforming device. It shall be
operable via remote control and shall not interrupt internal control power.

b) Remote/ Local Control Switch

A switch with detents for local regulator control shall be located for readily access without opening doors or removing covers. The switch positions shall be marked “Remote, off, B1, B2, B3” for a three step regulator and “Remote, off, B1, B2, B3, B4, B5” for a five-step regulator. The switch shall not rotate beyond an active position.

c) Output Ammeter

A flush-mounted, rms-reading ammeter to indicate output current shall be positioned on the front of the regulator so that it may be easily read. The meter accuracy shall be at least ±3.0% of the maximum output current.

d) Terminal Block

Pressured-type terminal blocks having a suitable voltage rating shall be installed in the control cabinet for connection of the external wiring associated with monitoring and remote control. Terminal blocks shall accommodate 0.5~3.5mm² wire with an insulation rating up to 600V shall be provided.

e) Enclosure

The reactors or transformer shall be housed in a enclosure of sheet steel or other suitable material. The enclosure shall be equipped with a removable cover that is held securely in place. Channels shall be attached to provide no less than 5 cm of space between the enclosure and the floor.

f) Control Cabinet

Control cabinet or compartment made of suitable materials shall be provided for housing the relays, the sensing devices, the control terminal block, the remote/local control switch, and other low voltage control components. It shall be either permanently attached to or an integral part of the enclosure. All low voltage control components shall be accessible by opening the cabinet. The cabinet shall close tightly to keep out insects or dust.

g) Wiring Diagram

A legible wiring diagram shall be permanently mounted in an unobstructed place in the control cabinet.
h) Painting and finishing

The inside and outside of the enclosure shall be given one prime coat and one finish coat of oilroof and weatherproof paint. The outside of the enclosure shall be touched up after assembly and testing are complete.

i) Lightning Arresters

Lightning arresters of the size necessary to protect the regulator shall be installed across the regulator output terminals. The ground side of the arresters shall be connected to the grounding lug of the enclosure or other suitable location. The lighting arresters shall suppress a test pulse on the output lines consisting of a 10 $\mu$s by 20 $\mu$s current surge of 15,000A with the subsequent power-follow current and a voltage surge of 10kv per $\mu$s minimum without damage to the regulator.

j) Warning Sign

A plate or decal shall be affixed to the front of the control cabinet door warning the maintenance technician to remove input and control power before opening the cabinet.

k) Marking and Packing

(1) Nameplate

A nameplate with the information below shall be securely attached to the front of the regulator enclosure. If the nameplate is attached to a readily removable surface, such as a cover, the serial number shall be duplicated in a permanent conspicuous place elsewhere on the regulator.

(a) Constant current regulator, single phase

(b) Input : _______ Volts _______ Hertz _______ Amperes

(c) Control : _______ Volts _______ Hertz _______ Amperes

(d) Output : _______ kw _______ at _______ Amperes

(e) Output current: _______ amperes. Gallons of oil ______

(f) Identification or serial No. _______

(2) Packaging

The quality of packing material shall be good so as to withstand the transportation and handling.

l) Installation

The Constant Current Regulator for AGLS should be installed in electric room according to design after checking each part.
a) Install according to circuit of the Constant Current Regulator and connect power & remote control cable to input/output terminal.
b) The Constant Current Regulator shall be arranged to form a continuous self-supporting board and alignment shall be laid linearly
c) During installation special care shall be taken to check all operating mechanisms for smooth operation.
d) All bolts and screws for mounting, assembling and anchoring the switch gear shall be appropriately treated to prevent corrosion.
e) The bottom of the panels shall be fire, dust and vermin-proof with seals around the cable entrance plate.

1.15.6 Low Tension Voltage Distributing Board

1) General

This panel shall be installed at CCR room in Main Power House and be used for supplying AC 440V or AC 220v to CCRs, illuminated wind direction indicators (IWDI), and others.

2) Materials

a) Cubicle

(1) The Cubicle (Low Tension) shall be used in a power distribution system as shown in the approved drawing.

(2) Enclosure shall have removable hinged doors on the front and rear side with key lock.

(3) The arrangement shall make the most economical utilization of available spare.

b) Buses

(1) Power shall be distributed by a main horizontal copper bus provided across the Distribution Switchboard, with vertical copper buses extending into each section to supply power to individual control center units.

(2) The horizontal and vertical buses shall be isolated by barriers that prevent personnel contact with energized buses while the Distribution Switchboard units are being serviced. Removable covers on the barrier shall be provided at convenient intervals to allow cubicles to be plugged on to the vertical bus.

(3) The main horizontal buses and bus connections shall be
completely insulated with non-hydroscopic track resistant material processing flame retardant self extinguishing properties.

4. A Copper grounding bus shall be furnished across the entire length of the Distribution Switchboard. The bus shall have full short circuit current capacity as shown in the design data.

5. Bus joints shall use pressure type bolted connections. Buses shall be silver-plated at all bus joints and connections.

6. Bus phasing arrangement shall be A-B-C, left to right, top to bottom, front to rear when viewed from the front.

7. Buses and supports shall be braced for the rated short circuit current as specified in the design data.

c) Circuit Breakers

1. Breakers shall be equipped with an external operating mechanism to allow operation from the front with the unit door closed. The operating mechanism shall clearly indicate whatever breaker is ON, OFF or TRIPPED. The opening on the door shall be provided with a gasket.

2. The breaker operating mechanism and unit door shall be interlocked to prevent opening the door when the breaker is in the ON position. Means shall be provided to bypass the interlock for maintenance.

3. Breakers shall be provided with auxiliary contacts, bell alarm switches and other accessories.

d) Coating and Painting

Equipment shall be cleaned, primed, and finish painted in accordance with the Contractor’s standard specifications.

Finish Color shall be in accordance with the design data. A sufficient quantity of touch-up paint shall be supplied, but in no case less than 0.5 liter per enclosure of the complete assembly.

e) Marking and Packing

1. Nameplate

The metal nameplate which has contents as following shall be installed on the Distribution Switchboard.
(a) Type, the name of product  
(b) Approval number  
(c) Manufacture data and number  
(d) Manufacturer’s name  
(e) Ratings  
(f) Signature space

(2) Packaging  
The quality of packing material shall be good so as to withstand the transportation and handling.

1.16 AIRFIELD LIGHTING CABLE AND OTHERS

1.16.1 Airfield Lighting Cable

1) Underground Series Circuit Cable (5.0kV, XLPE Insulated and PVC Sheathed Cable) Series circuit cables to be used in this works shall be 8 mm² or more size single core, ethylene-polypropylene rubber insulated, polychloroprene sheathed and corrugated metal armored with PVC outer covering cables of the following specifications:

<table>
<thead>
<tr>
<th>Voltage Rating</th>
<th>kV</th>
<th>6.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Conductor</td>
<td>mm²</td>
<td>1</td>
</tr>
<tr>
<td>Nominal sectional area</td>
<td>No./ mm</td>
<td>8</td>
</tr>
<tr>
<td>Conductor No. and Dia of wires</td>
<td>mm</td>
<td>7/1.2</td>
</tr>
<tr>
<td>Outside Dia</td>
<td>mm</td>
<td>3.6</td>
</tr>
<tr>
<td>Insulation Thickness</td>
<td>mm</td>
<td>4.0</td>
</tr>
<tr>
<td>Sheath Thickness</td>
<td>mm</td>
<td>1.8</td>
</tr>
<tr>
<td>Outside Dia of Sheath</td>
<td>kV</td>
<td>11.6</td>
</tr>
<tr>
<td>Overall Dia of Cable, Approx.</td>
<td>megohm</td>
<td>16.5</td>
</tr>
<tr>
<td>AC Test Voltage(for 10 Minutes)</td>
<td></td>
<td>17.0</td>
</tr>
<tr>
<td>Insulation Resistance for 1,000m (20°C) min.</td>
<td></td>
<td>2,500</td>
</tr>
<tr>
<td>Conductor Resistance per 1,000m (20°C) max.</td>
<td>ohm</td>
<td>2.31</td>
</tr>
<tr>
<td>Weight of Cable per 1kg, Approx</td>
<td>kg</td>
<td>365</td>
</tr>
</tbody>
</table>

a) The cable conductor shall be tin or lead-alloy coated annealed stranded copper wire.

b) The average thickness of the insulation and sheath shall not be less than
90% of the value given in the above table.

c) The average thickness of the polychloroprene sheath (which will be black in color) shall be not less than 90% of the value given in the above table.

2) Extension Cables (2PNTC Cable) and Wires

The extension cable between the isolating transformer and light fitting shall be 3.5 mm², double-core, ethylene-polypropylene rubber insulated, polychloroprene sheathed portable cable.

<table>
<thead>
<tr>
<th>Voltage Rating</th>
<th>KV</th>
<th>0.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Conductor</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Nominal sectional area</td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>Conductor Composition No. of Wires/Dia of wire</td>
<td>mm”</td>
<td>45/0.32</td>
</tr>
<tr>
<td>Outside Dia</td>
<td>No./mm</td>
<td>2.5</td>
</tr>
<tr>
<td>Thickness of Separator</td>
<td>mm</td>
<td>0.05</td>
</tr>
<tr>
<td>Thickness of Insulation</td>
<td>mm</td>
<td>0.8</td>
</tr>
<tr>
<td>Cabling Dia, Approx.</td>
<td>mm</td>
<td>8.4</td>
</tr>
<tr>
<td>Thickness of Sheath</td>
<td>mm</td>
<td>1.9</td>
</tr>
<tr>
<td>Overall Dia of Cable, Approx.</td>
<td>mm</td>
<td>12.5</td>
</tr>
<tr>
<td>Weight of Cable per 1,000m, Approx.</td>
<td>kg</td>
<td>245</td>
</tr>
<tr>
<td>Conductor Resistance per 1000m(20C) max.</td>
<td>Ohm</td>
<td>5.54</td>
</tr>
<tr>
<td>AC withstanding Voltage for 1 minute</td>
<td>Kv</td>
<td>3.0</td>
</tr>
<tr>
<td>Insulation Resistance for 1,000m(20C) min.</td>
<td>Megohm</td>
<td>400</td>
</tr>
</tbody>
</table>

1.16.2 Plug and Receptacles

1) All Plugs and Receptacles shall be in compliance with FAA L-823 specification (AC 150/5345-26D).

2) Plugs and receptacles for the 5kV single-core cables shall be designed for 25A current, and for the 600wo-core cables for 20A.

3) The plug and receptacle shall be watertight and shall withstand continuous use under the designed ambient temperature range.

4) The connected plug and receptacle shall resist a pulling force equal to a static weight of 5 kg without becoming disconnected.

5) All plugs and receptacles shall be identical and of uniform manufacture.
1.16.3 Isolating Transformer

1) General

The Isolating Transformer shall be in compliance with ICAO Aerodrome Design Manual, Part 5, para 3.2.1.7 and FAA AC 150/5345-47B.

The lamps of each light are fed individually from transformers, the primary windings of which are connected in series. Series circuits are operated with AC voltages of up to 5,000V and a current of preferably 6.6A. By reducing the voltage to the series circuit, it is possible to uniformly adjust the brightness for all the lamps in the airport lights, independently of the distance of the lights from the point of supply.

2) Materials

a) Transformer

The transformer shall consist of primary and secondary coils wound upon a core and enclosed in a waterproof case with rubber connectors molded on the primary and secondary leads.

b) Case

The transformer shall be enclosed in permanently sealed cases in such a manner as to produce a completely watertight assembly. No portion of the case shall be less than 1/4-inch thick, and it shall be free of cracks, blisters, holes, etc., which would be detrimental to transformer service life. Sharp corners and edges of the core and coil assembly shall be eliminated or adequate provisions made so that they will not cut the case if the transformer is dropped or handled roughly. The case shall be constructed so that moisture accidentally getting into the leads or connectors cannot be conducted through the leads into the windings of the transformer.

c) Transformer Leads

2 single-conductor primary leads. Lead connections may be of the solder or of the solderless type. If solderless connectors are used in joining for that application and properly applied. Care shall be exercised during molding to insure that proper clearance exists between these connections after the molding operation has been completed. All three leads shall emerge from one end of the transformer.

(1) Primary Leads

Equip one primary lead (H1) with a plug type connector. Equip the other primary lead (H2) with a receptacle. Use NO. 8 mm², single-conductor cable insulated for not less than 5,000 volts.
Extend each primary lead 60 cm ± 7.5 cm beyond the housing, including the connector.

(2) **Secondary Leads**

Equip the secondary lead with a receptacle. The receptacle shall be so wired that the large contact will connect to the X1 lead of the transformer secondary and the smaller contact will connect to the X2 lead. Use 3.5 mm² or 2.0 mm² two-conductor, 600 volts, as secondary cable. Extend the secondary lead cable 120 cm ± 7.5 cm beyond the housing including the cable connector.

d) **Nameplate**

The markings shall be molded on the case surface of the transformer as follows.

**Rating : _____W _____V _____Hz**

Primary _____A, Secondary _____A

Manufacture Name or Trade-mark _____

e) **Dimensions**

The dimensions of the transformer shall be such that the transformer shall fit easily into a space defined as a cylinder, 200 mm in diameter by 250 mm in height.

f) **Electrical Characteristics**

The electrical characteristics of the transformers shall be shown in Table 1.

<table>
<thead>
<tr>
<th>Type</th>
<th>Rating Primary</th>
<th>Secondary</th>
<th>Full Load A</th>
<th>Load Ω</th>
<th>Short Circuit A</th>
<th>Short Circuit V</th>
<th>Open Circuit A</th>
<th>Open Circuit V</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT-45-66</td>
<td>30/45 5000 50/60</td>
<td>6.6 6.6 6.6</td>
<td>95 90</td>
<td>6.53-6.67 1.15</td>
<td>6.6-7.1 25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT-65-66</td>
<td>65 5000 50/60</td>
<td>6.6 6.6 6.6</td>
<td>95 90</td>
<td>6.6-7.1 1.6</td>
<td>6.6-7.1 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT-100-66</td>
<td>100 5000 50/60</td>
<td>6.6 6.6 6.6</td>
<td>95 90</td>
<td>6.6-7.1 2.44</td>
<td>6.6-7.1 70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT-100-266</td>
<td>100 5000 50/60</td>
<td>20 6.6 20</td>
<td>95 90</td>
<td>6.6-7.1 2.44</td>
<td>6.6-7.1 70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT-200-66</td>
<td>200 5000 50/60</td>
<td>6.6 6.6 6.6</td>
<td>95 90</td>
<td>6.6-7.1 4.82</td>
<td>6.6-7.1 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT-200-266</td>
<td>200 5000 50/60</td>
<td>20 6.6 20</td>
<td>95 90</td>
<td>6.6-7.1 4.82</td>
<td>6.6-7.1 100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.16.4 Cable Installation

1) General

The approximate routes of the cables are shown in the Drawings. Actual laying positions of the cable ducts, trenches, and of cable supports shall be determined with due regard to any obstacles that might exist as well to accessibility of all such routes, subject to the approval of the Engineer prior to the installation.

2) Conduit (Ducts encased in concrete)

Ducts encased in concrete shall be used where cables are installed. Concrete-encased duct or rigid steel conduit should be installed so that the top of the concrete envelope or conduit is not less than 40cm below bottom of the paving where it is installed under roadways, railroads, runways, taxiways other paved area, and ditches and not less than 40cm below the finished grad elsewhere.

3) Separation of Cables

The series circuit cables, power cables, control cables and cables of radio navigational aids and communications shall be allocated separate ducts encased in concrete.

When the supply and return circuits of a series circuit are routed together, the cables for both directions shall be laid in the same ducts encased in concrete.

However, when one lighting system receives its power supply through 2 circuits, the cables for each circuit shall be laid in separate ducts.

All cables shall be buried at least 400mm below finished grade except transformer secondary cable.

Power cables, of the same circuit, may be laid side by side in the trench without separation, except as note below series lighting cables may be considered as of the same circuit.

Minimum spacing between cables to be maintained.

- Power cables of the same or different circuit of less than 600 volts, may be laid together in the same trench without horizontal separation
- Between 5kV cables and 600V cables 100mm
- Between 5kV cables and control, telephone, coaxial type cables 150mm
- Between more than 5kV cables and the other cables 300mm
● Control telephone and coaxial cables may be laid in the trench without horizontal separation from each other.
● Ground wires and counterpoises should be approximately 15 cm above the uppermost level of the cables.

4) Bare Copper Wire

A stranded bare copper wire 16mm² minimum size, shall be installed for lightning protection of the underground cables.

The bare copper shall be installed in the same trench for the entire length of the insulated cables and shall be placed at a depth of approximately 30cm above the insulated cables. Where cables are installed in parallel and their width exceeds 30cm, the bare copper wire shall be installed in each 30cm width.

5) Cable Markers

Cable markers shall be provided and installed with the top surface flush with ground level to identify cable routes and joint positions other than tee joints, or cables laid direct in the ground. Markers shall be inscribed with indented lettering reading “H.V.” or “Cable Joint” as appropriate and shall be installed at every 50m along the route and at any change in direction.

1.16.5 Transformer Box (Steel Base)

Transformer boxes made of Steel box (Base box): Base box shall be erected as shown in the Drawings along and approximately equidistant from the edge of both shoulders. Each transformer box shall be connected to the mounting base box of the corresponding light unit by 54mm diameter galvanized steel pipe and flexible stainless pipe.

1.16.6 Excavation and Backfill Work

1) Excavation

The depth and width of excavation shall be minimized for the installation of the above facilities. The bottom plane of excavation plane of excavation shall be flat.

2) Backfill

The excavated material shall be used for backfill. Refilling shall be put in horizontal layers not exceed 25cm in depth along the cable, and shall be compacted to the original ground condition.
1.17 INSPECTION AND TEST

1.17.1 General

Contractor shall be required to arrange test and inspection to cover the specification requirements. The tests are classified to two kinds of tests i.e., production test and field test.

1.17.2 Production Test

Production test shall be performed for all equipment to ensure that all equipment is consistent in quality and performance with the requirements of this Specification. The production shall consist of a “Production Inspection”, “System Test” and “Continuous Operation Test” as follows:

1) Production Inspection

Each item of completed equipment supplied as an integral part of system under the Contract shall have mechanical and electrical inspection. The mechanical inspection will include a visual examination to determine compliance with the applicable specifications covering fabrication requirements such as strength and rigidity; accessibility; type of components and materials; class of insulation; layout of chassis, panel and wiring; finish; etc. The electrical inspection shall include observation and review of test which the Contractor shall perform to determine compliance with the applicable specifications (including those of the Contractor) covering electrical requirements and performance.

2) System

Each complete system shall be tested to ensure that each subsystem and the total system are fault-free and conform to the requirements of this Specification within the tolerance.

3) Continuous Operation Test

Equipment shall be subjected to a minimum of one month heat-run operations as the final step in production test before the equipment is packed for shipping. In the event of a failure during the test, corrective action shall be taken. The Contractor shall advise the Engineer of the cause of any failure and the corrective action taken. Final approval by the Engineer shall be required before the equipment shipping.

1.17.3 Factory Acceptance Test

The test shall be made at the Contractor’s factory and on responsibility in the presence of the Employer’s representative.

The Contractor shall bear the cost of transportation of the employer’s representatives
from/to their hotel, from/to Philippine by normal fare, and daily allowance covering hotel accommodation, food and daily expenses.

The maximum number of representatives is as follows:

Lighting and control system: 3 persons for ten (10) days

The notification of test and submission of test procedures shall be submitted at least one month in advance.

### 1.17.4 Field Test

The Contractor shall perform all field tests to ensure that all the systems are functioning well and perform all the requirements of this Specification.

1) **Submission of Test methods Proposal**

   The Contractor shall prepare and submit the field test methodology including data form, etc., at least 30 days before the field test.

2) **Commissioning Test**

   Commissioning test of the system shall be carried out after it has been installed and tested. No commissioning tests shall be commenced without prior approval of the engineer. The Contractor shall conduct the commissioning test which, however, shall be carried out under the direction of the Engineer.

   Should the system or any portion thereof fail under test to give the performance required, then any further test(s) which may be considered necessary by the Engineer shall be carried out in a similar manner, by the whole cost of the repeated test(s) shall be borne by the Contractor.

3) **Flight Test**

   Airfield lighting system shall be subject to Flight Test by the Employer. This test shall conform to those set out in the ICAO Manual Doc. 8071. Annex 10 and Annex 14. Employer will make arrangement for the aircraft and personnel necessary for the flight test. During flight test to be carried out by the Employer, the Contractor shall make available at the site his personnel for the purpose of assisting the Employer to carry out the test smoothly and satisfactorily.

   In the event of re-testing by flight to be conducted by the Engineer as a result of any such defects, the Contractor shall make available at the site his personnel who witnessed the initial flight test.

   Final acceptance shall be done after the completion of the flight test.

   The cost of all personnel, equipment, flight test change, etc., shall be deemed to be
included in the Contract Price.

1.18 TRAINING, SPARE PARTS, TOOLS AND MEASURING EQUIPMENT

1.18.1 Training

1) General

Contractor shall provide training for the Employer’s staff on the maintenance, adjustment and repair of main items of equipment offered.

2) Factory Training

a) The Contractor shall provide training for three (3) Owner’s staffs at the manufacturer’s factory. The training course shall be designed to bring up the trainees to sufficient level for the proper operation and maintenance of the proposed system. The training period of AGLS shall be for a minimum of fourteen (14) days. The Contractor shall provide the round trip airfare, training fees, educational materials, official trip expenses (hotel fee, meals, daily allowances), etc. Official trip expenses shall be provided in accordance with the Guidelines of the Civil Service Commission of the Philippines.

b) The training shall be planned to be completed with one (1) month before the starting of equipment installation.

c) The Contractor shall also be responsible for providing transportation facility during the training period on site.

3) Site Training

Site training of not less than 14 substantial days period shall be carried out before the commissioning and flight test. The number of trainees is as follows:

Control equipment : 5 persons  
Field equipment : 5 persons

1.18.2 Spare Parts Required

1) Fuses

Spare parts for fuses shall comprise all types, kinds and sizes used in and required for each equipment item for each system; quantity shall be equivalent to not less than one hundred percent (70%) of each type required for Work as installed.
2) Lamps

Spare parts for lamps shall comprise all types, kinds and sizes used in and required for each equipment item for each system; and in quantity shall be equivalent to not less than fifty percent (20%) of each type required for Work as installed excluding apron floodlighting. In case of apron floodlighting number of spare lamps shall not be less than 20%.

3) Light Fixtures

Spare parts for light fixtures shall comprise all types required as installed for Work under this Contract, except for Aerodrome Beacon and Illuminated Wind direction Indicator; and quantity shall be equivalent to 10 percent (10%) of total number of fixture units installed, but not less than 2 units.

4) Isolating Transformers

Spare parts for isolating transformers shall comprise all types required as installed for work under this Contract; and quantity shall be equivalent to 10 percent (10%) of total number of fixture units installed.

5) Filters

Spare parts for filters shall comprise all types required as installed; and quantity shall be equivalent to 10 percent (10%) of total number of units installed, but not less than 2 units.

6) Thyristors

Spare parts for thyristors shall comprise all types required as installed; and in quantity shall not be less than 2 sets.

7) Cable and Wire

Spare parts for Cable and Wire shall comprise all types required as installed; and quantity shall be as follows:

- 5kV Circuit Cable : 2,000 meters
- 600 Volt Extension Cable : 1,000 meters

8) Plug and receptacle Sets

Spare parts for plug and receptacle sets shall comprise all types required as installed; and in quantity shall be as follows:

- 5kV Circuit Cable : 20 sets
1.18.3  Tools

1) Two complete sets as required for each equipment item or system of work.

2) Comprising all necessary lubricating tools and supplies; and any specialized hand tools necessary for operation, adjustments or regular upkeep service which are of types not usually carried or readily available.

3) Each set contained in suitable metal box or panel; outside of container clearly identified respective to equipment for which required.

1.18.4  Measuring Equipment

When measuring equipment required for maintenance as specified are not readily and commercially available at Project site, two complete sets shall be furnished.

1.19  WARRANTY

The Contractor shall warrant that no system down or performance degradation will be encountered for three (3) years after the date of final acceptance. During the warranty period, the Contractor shall provide materials and technical services without any cost to the Owner. However, the Contractor shall be responsible for equipment problems caused by any design and production faults regardless of warranty period. In case any problem occurs, the Contractor shall replace defective parts of equipment with new parts without any cost or additional compensation for its replacement.

1.20  PREPARATION FOR DELIVERY

1) PRESERVATION AND PACKAGING

Preservation and packaging of items shall be in accordance with best commercial practice.

2) PACKING

Packing of items shall be in accordance with best commercial practice. No more than one of each item and associated hardware shall be packed in each shipping container.

3) MARKING

Each packing and shipping container shall be durably and legibly marked with the following information:

a) Name of item
b) Serial number(s)
   c) Quantity
d) Contractor number

e) Gross weight of container

f) Manufacturer’s name
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DIVISION 1: ELECTRICAL WORKS GENERAL REQUIREMENTS

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<td>7</td>
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<tr>
<td>1.3 EXECUTION</td>
<td>9</td>
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</tbody>
</table>
1.1 GENERAL

Part 1 – General Requirements and the General Conditions of Contract contain provisions and requirements essential to these Specifications and shall apply to this Division, whether or not referred to herein.

1.1.1 Applicable Publications

The materials, equipment and methods of installation comprising the complete works, shall be in accordance with the latest applicable codes, standards and guidelines published by the following organizations:

a) American National Standards Institute (ANSI) Publications
b) National Electrical Manufacturers Association (NEMA) Publications
c) International Electro technical Commission (IEC)
d) Korea Industrial Standard (KS)
e) International Civil Aviation Organization (ICAO)
f) Federal Aviation Administration (FAA)
g) Korea Electrical Manufacturer’s Cooperative Standards (KEMC)
h) Korea Electric Power Corporation Standards.
i) Korea Electric Installation Standards.
j) Philippine Electronic Code
k) Institute of Electrical and Electronic Engineers.

1.1.2 Scope of Work

The work to be done under Part C of these Specifications includes the furnishing of all tools, labor, supervision, equipment, fixtures and all necessary materials, each complete and in proper working condition, to complete the following items of work:

1) General

Complete supply and installation of standby generator sets, paralleling switchboard and concrete pad, including all accessories to complete.

2) Visit to Site

The Contractor is advised to visit the site and satisfy himself as to the local conditions and facilities that may affect his work. He will be deemed to have done this before preparing his proposal and no subsequent claim on the ground of inadequate or insufficient information shall be entertained.

3) Subcontracting

The contractor shall not subcontract the whole or any part of the work without the written consent of the Employer/Engineer. The Contractor shall be responsible for any work carried out by his Subcontractor, should he be allowed to have one, as if he himself were undertaking the work.

4) Injury to Persons or Damage to Property

The Contractor shall be responsible for any injury to persons and or damage to property caused by the work or by his employees and shall be liable for any claims against the Employer as a result of such injury and/or damage. The Contractor shall likewise protect the property of the Employer against theft and weather. Where
exposure to weather or theft is due to the work or negligence of the Contractor, he shall be liable for such damage or loss.

5) Materials/Substitution/Tests

All materials to be installed shall be brand new and shall conform to Specifications except as otherwise noted on the plans. All materials where not specified shall be of the best of their respective kind. Samples of said material shall be submitted for approval. Manufacturer’s data of substitute materials shall also be submitted for approval. Tests required on the installation shall be made by the Contractor in the presence of the Engineer. The Contractor shall within twenty eight (28) days before the commencement of the work, submit a list of the materials he proposes to use. All materials installed without prior approval shall be at the risk of the Contractor.

6) Workmanship/Coordination/Guarantees/Suspension or Delay

a) The Work throughout shall be executed in the best and through manner under the direction of and to the satisfaction of the Engineer, who shall have the power to reject any work and material, which in his judgment, are not in full accordace with these Specifications and Drawings. The Contractor shall be familiar with the Specifications of all the trades involved in his work and shall coordinate each trade thoroughly so that he can arrange his work and dispose of his materials without interfering in his other works involved in the completion of the project. The Contractor shall guarantee that the electrical systems shall be free from all defects or workmanship and materials and that they will remain so for a period of three (3) years from the date of acceptance by the Engineer. Any remedy to correct defects deemed to be caused by such shall be made at expense of the Contractor.

b) The Contractor shall not suspend or delay the work without justifiable cause. Subsequent delays shall be deemed as a sufficient cause for penalties or termination of contract in which the Employer shall have the right to take over the work and all materials on the site and make arrangements as are necessary to complete the work. It shall be the sole responsibility of the Contractor to conduct coordination of his activities to other trades.

7) Sleeves/Inserts/Cutting/Patching/Backfill

The contractor shall provide all openings, sleeves, and inserts in walls, floors, and beams as required for his work. All unused openings shall be grouted in. The Contractor shall do all patching requirements necessary and this shall be done so as to exactly match the surroundings without the evidence of alteration or patching. The Contractor shall provide all necessary backfill on all excavation works of his doing.

8) Temporary Light and Power

The Contractor shall make all arrangements and pay for the provision of the necessary electrical power of the type and capacity required for the performance of the work of all trades engaged in the construction of the building.

9) Cleaning Up

The Contractor shall remove all dirt, debris, rubbish and waste materials caused by him in the process of his work. He shall also remove all tools, temporary power
installation, scaffolding and surplus materials after completion and acceptance of work.

10) **Quality Control**

The Contractor shall employ a licensed Electrical Engineer to perform continuous inspection of all Electrical Works. The Electrical Engineer shall be at the site during all electrical construction and perform the following duties:

a) Review Drawings and Specifications and meet with the Engineer to discuss all the requirements before the work commences.

b) Before the electrical work commences, meet jointly with the Engineer to review the requirements for surveillance and quality control.

c) Ensure that all electrical work complies with applicable electrical codes and standards.

d) Perform or supervise required testing.

e) The supplier shall provide comprehensive details of other similar installations he has completed in the past two years, which have utilized equivalent ratings and configurations of high and low voltage switchgear, standby generators operating in parallel and other equipment to be supplied under this contract.

11) **Submittals**

a) The Contractor shall obtain approval before procurement, fabrication, or delivery of items to the Site. Partial submittals will not be entertained and will be returned without review. Submittals shall include the manufacturer’s name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, technical society publication references, and other information necessary to establish contract compliance of each item to be furnished.

b) The contractor shall submit construction statement and schedule for approval twenty-eight (28) days upon receiving the notice to proceed. These data shall include:

(1) Connection work to the external power supply
(2) Material and plant acquisition
(3) Construction and installation
(4) Tests

12) **Shop Drawings**

a) The contractor shall submit to the Engineer five (5) sets of shop drawings (including a reproducible original) and cuts of equipment, appliances and fixture furnished which shall include details of actual installations, such as conduit runs, wiring, location of equipment and other pertinent information to illustrate deviation and changes from the original plans.
b) Shop drawings shall be a minimum of 450 mm by 600 mm in size, except as specified otherwise. Shop drawings shall include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Shop drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, the Contractor shall revise shop drawings to show acceptable equipment and resubmit.

13) Manufacturer’s Data

Submit for each manufactured item shall be current manufacturer’s descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristics curves, and catalog cuts.

14) Manufacturer’s Instructions

The Contractor shall provide the following manufacturer’s instructions:

a) Manufacturer’s directions for use of ground megger with proposed method indicated.

b) Terminator manufacturer’s installation instructions.

c) Typical installation instructions for jointing and terminating kits.

15) Certified Laboratory Test Reports

Submit manufacturer’s type test reports for all major equipment.

16) Field Tests Reports

a) At least 12 weeks prior to carrying out any testing or commissioning work the Contractor shall submit a complete set of typical test record sheets intended for use on the Project for review by the Engineer.

b) The Contractor shall provide calibration certificates for all test instruments proposed to be used for the testing, which shall indicate that the instrument was calibrated against a standard instrument within the previous twelve months. Copies of these certificates shall be kept with the test instrument at all times for inspection by the Engineer if required.

c) Completed test reports signed and dated by the Contractor carrying out the test and by any witness of the Engineer, shall be forwarded to the Engineer within one week of the test being carried out.

17) Spare Parts Data

After approval of materials and equipment, furnish list of recommended spare parts for two years use of each major item of equipment supplied. Include current unit
prices and supply source details. The provision of spare parts shall not relieve the Contractor of responsibilities under the guarantee.

18) **Publication Compliance**

a) Where equipment or materials are specified to conform to industry and technical society publications or organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

b) In each of the publications referred to herein, the Contractor shall consider the advisory provisions to be mandatory, as though the word “shall” had been substituted for “should” wherever it appears. References in these publications to the “authority having jurisdiction”, or words of similar meaning, shall be interpreted to mean the Engineer.

c) In lieu of the label or listing, submit a certificate from an approved independent testing organization, adequately equipped and competent to perform such services, stating that the item has been tested in accordance with the specified organization’s test methods that the item conforms to the specified organization’s publication.

19) **Certification of Compliance**

a) The contractor shall submit manufacturer’s certifications as required on products, materials, finish, and equipment indicated in the Specifications.

b) Certifications shall be documents prepared specifically for this Contract. Preprinted certifications and copies of previously submitted documents will not be acceptable.

c) The manufacturer’s certification shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item.

d) Certification shall not contain statements to imply that the item does not meet requirements specified, such as “as good as”, “achieve the same and use and results as materials formulated in accordance with the referenced publications”, or “equal or exceed the service and performance of the specified materials”. Certifications shall simply state that the item conforms to the requirements specified. Certificated shall be printed on the manufacturer’s letterhead and shall be signed by the manufacturer’s official authorized to sign certificate of compliance.

20) **Operation and Maintenance Manuals**

a) The Contractor shall submit Operation and Maintenance Manuals as required for systems and equipment indicated in the technical sections.

b) Manuals shall be furnished in six (6) copies, bound in hardback binders or an approved equivalent. Furnish one complete manual prior to performance of systems or equipment test and furnish the remaining manuals prior to contract
completion. Inscribe the following identification on the cover: the words "OPERATION AND MAINTENANCE MANUAL", the name of and location of the system, equipment, building, name of Contractor, and Contract number.

c) In the manual, the names, addresses, and telephone numbers of each subcontractor installing the system or equipment shall be included. Include a table of contents and assemble the manual to conform to the table of contents, with the tab sheets placed before instructions covering the subject. The instruction shall be legible and easily read, with large sheets of drawings folded in. The manual shall include:

1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.

2. A control sequence describing start up, operation, shutdown

3. Description of the function of each principal item of equipment

4. Installation and maintenance instructions

5. Safety precautions

6. Diagrams and illustrations

7. Testing Methods

8. Performance data

9. Lubrication schedule including type, grade, temperature range, and frequency

10. Parts List: The list shall indicate sources of supply, recommended spare parts, and name of servicing organization

11. Appendix: List qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications

21) Posted Operating Instructions

Approved operating instructions for systems and equipment indicated in the technical sections shall be furnished for use by operation and maintenance personnel. The operating instructions shall be posted and shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. The Contractor shall print or engrave operating instructions and frame under glass or in approved laminated plastic. Instructions shall be posted as directed. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

22) Instruction to Employer’s Personnel

a) Where indicated in the technical sections, the Contractor shall furnish the services of competent instructors to give full instructions to the Employer’s
personnel in the adjustment, operation, and maintenance of systems and equipment, including pertinent safety requirements as required. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in the operating theory as well as practical operation and maintenance work.

b) Instruction shall be given during the first regular workweek after the equipment or systems has been accepted and turned over to the Employer for regular operation. The number of man-days (8 hours) of instruction furnished shall be as specified in each individual section.

23) **Delivery and Storage**

The Contractor shall handle, store, and protect equipment and materials in accordance with the manufacturer’s recommendations and with the requirements of NEMA 70B, Appendix I, titled “Equipment Storage and Maintenance During Construction”. Damaged or defective items shall be replaced with new items by the Contractor at his own expense.

24) **Manufacturer’s Recommendation**

Where installation procedures or any part thereof are required to be in accordance with manufacturer’s recommendations, the Contractor shall furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.2 **PRODUCTS**

1.2.1 **Material Requirements**

a) All materials and equipment to be supplied shall be as shown in the Drawings and shall be in accordance with the requirements to these Specifications which shall apply to manufacturers, testing and supply of same materials and equipment.

b) The Contractor shall take all responsibilities for ordering the correct and sufficient quantities of cables and equipment and shall, immediately prior to placing any order, and especially orders from imported goods, if any, ascertain the required quantities thereof.

c) All materials to be provided shall be brand new and in accordance with the latest edition of PEC (Philippine Electrical Code), Part I, ASTM (American Society for Testing and Materials) Standards, NEMA (National Electrical Manufacturer’s Association Standards, UL (Underwriter’s Laboratories) approved standards.

d) The manufacturer of the materials and equipment shall be open to inspection by the Engineer or his representative in the course of manufacture of the materials or equipment or after they have been completed.

e) Any materials and equipment found on such inspection not meeting the requirements of relevant standards, or of these Specifications shall be rejected by the Engineer.
f) Material tests on the cables and equipment shall be carried out in accordance with the ASTM Standards or other approved Standards, subject to the approval of the Engineer.

g) The Contractor shall, if required, forward to the Engineer, manufacturer’s certificate showing that the equipment have been tested and complied with the requirements of these Specifications.

h) Should the Engineer decided not to be present on the manufacturer’s premises, the Contractor shall submit to the Engineer all test certificates, proof sheets, etc., showing that the materials comply with the requirements of the Specifications. However, the absence of the Engineer at the Manufacturer’s tests shall not:

1) Relieve the Contractor of any of his obligation,

2) Affect the right of the Contractor of any of his obligation,

3) Affect the right of the Engineer to require additional test to be carried out by an independent person appointed by him, at such place or places as he may determine.

i) The cost of all tools, instruments and personnel necessary to carry out the tests on the Manufacturer’s premises or at places indicated by the Engineer shall be deemed to be included in the rate for the appropriate items of the price Schedules.

j) Testing on the site shall be as specified herein or as directed by the Engineer.

k) All materials, fixtures and accessories whether specifically described or not shall be of the best grade and all workmanship shall be first class in every respect.

1.2.2 Painting

a) Prior to painting panels, all parts shall be degreased and shall undergo phosphating.

b) All surfaces of panels shall then receive a minimum of one coat of high quality primer paint necessary to prepare the surface for 2 final coats of high quality gloss finish, baked in an oven in order to achieve an extremely uniform and very hard protective film.

c) Any steel parts normally left bright shall be cadmium plated or chrome plated.

d) After the equipment has been installed on site and fully wired, any scratched or chipped portions of the painting work shall be touched-up by spraying on so as to present a clean surface, free from patches. Brushing-on of paint for this purpose is not acceptable.

1.2.3 Labels

a) All equipment and other apparatus and controls shall be labeled in accordance with the requirements of this Specification.

b) All labels shall be polycarbonate plastic or similar, engraved black lettering on white. The size of lettering and the wording of labels shall be submitted for approval prior to manufacture.
c) Major equipment items shall be fitted with a main label mounted in a prominent position.

d) Labels shall be secured with brass screws or steel screws which have been rust proofed in an approved manner.

e) Labels shall designate circuit number and equipment function.

f) Appropriately worded and sized warning labels engraved white on red shall be fastened to all covers or panels giving access to live equipment. Panels giving access to equipment at voltages of 500V and above shall additionally warn “Danger – High Voltage”.

g) Terminal strips shall be labeled to identify the circuit number, phase connection, terminal number and function – e.g. control, indication, protection etc.

h) Contractors, fuses and other items of equipment shall be clearly labeled to identify circuit number, function and rating.

1.2.4 Cataloged Products/Service Availability

The equipment item shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the Defects Liability Period of the Contract.

1.3 EXECUTION

1.3.1 Codes, Inspections, Permits and Fees

a) The work under this Contract shall be the complete installation of electrical system in accordance with the requirements of the latest edition of Philippine Electrical Code, Part I, and of the local power company. Nothing contained in the Specifications or shown on the Drawings shall be construed in conflict with the National and Local Ordinances or laws, governing the installation of electrical work and all such laws and ordinances are hereby made part of these Specifications. The Contractor is required to meet the requirements of the National and Local Ordinances or Laws.

b) All permits and electrical fees required for this Work or the whole Electrical Work for the Contract, shall be obtained by and at the expense of the Contractor. The Contractor shall furnish the Engineer and the Employer final certificates of inspection and approval from the proper government authorities after the completion of the work but prior to issuance of Certificate. The Contractor shall prepare all “As Built” drawings and all other paper works required by the approving authorities.

c) The Contractor shall contact the local electric utility and discuss the connection method, schedule and fees. Necessary materials specified in this Specification shall be furnished to them. Connection fee shall be paid in accordance with pay item in the Price Schedule.
1.3.2 Guarantee

a) The Contractor shall guarantee that the electrical systems are free from all unintentional grounds, from all defective workmanship and materials, and will remain so for a period of one year from the date of issuance of the Certificate of Acceptance. Any defects arising within the aforesaid period shall be remedied by the Contractor at his own expense without additional payment.

b) In case that the guarantee period by manufacturers is still remaining after the Defects Liability Period, such balance of guarantee period shall be transferred to the Employer without any additional payment. The Contractor shall specify this requirement in the related sub-contract documents with the manufacturer.

c) The Contractor shall indemnify the Employer and the Engineer from and against all liabilities and damages arising from the injuries or disabilities to persons or damage to properties, occasioned by any act or omission of the Contractor or any of his sub-contractors, including any and all expenses legal or otherwise, which may be incurred by the Employer or the Engineer, in the defense of any claims, action or suit.

d) As an exception to requirements that may be stated elsewhere in the Contract, the Engineer shall be given 4 working days notice prior to each tests.

1.3.3 Electrical Equipment and Materials

Unless indicated or specified otherwise, install materials and equipment in accordance with the standards, codes, and regulations listed in the specifications. Install all equipment in strict conformance with manufacturer’s instructions and recommendations.

1.3.4 Installation

Installation works shall conform to the requirements of PEC and NFPA 70: National Electrical Codes. Unloading, moving, and installation of equipment shall be under direct supervision of a competent and experienced installation engineer. The Contractor shall provide all labor, tools, equipment etc., for erection and installation of the equipment.

1.3.5 As-Built Drawings

The Contractor shall, during the progress of the work, keep a careful record of all changes where the actual installation differs from that shown on the Drawings.

Upon completion, the Engineer shall be furnished at no cost, a complete set of sepia prints on which the Contractor shall, in a neat and accurate manner make a complete record of all changes and revisions to the original design, as installed in the completed works. These drawings shall be submitted to the Engineer for approval. After approval, the complete set of As-Built drawings in both electronic format and hard copy shall be provided to the Employer. Final payment will be withheld until receipt of the approved As Built Drawings.

1.3.6 Shop Drawings and Samples

After final approval by the Engineer, a sufficient number of copies as directed shall be furnished for distribution. Fixture and device cuts and/or catalogues shall be clearly marked to indicate the items furnished. Do not submit individual sheets, cuts and catalogues or drawings or details of equipment, locations of sleeves, insert and support as may be required for the
assistance and the coordination of his work with that of the other Contractors for other mechanical trades.

1.3.7 Coordination

a) The Contractor shall cooperate in every way and work with other contractors in whose apparatus he shall connect part of his work, and also provide in his connections and facilities for the continuity of their work. The Contractor is hereby called upon to prepare such drawings or details of his equipment, locations of sleeves, insert and support as may be required for the assistance and the coordination of his work with that of the other contractors for the mechanical trades.

b) The Contractor shall furnish these drawings upon demand, in adequate numbers for the information of all parties concerned. The Contractor shall coordinate the preparation of these drawings by consultation with the trades involved, before submitting them. The approval of such drawings will not relieve the Contractor in any way from the responsibility of properly locating his work with the work of others.

1.3.8 Minor Modification

The Drawings are based upon architectural plans and details show conditions as accurately as it is possible to indicate them in scale. The Drawings are diagrammatic and do not necessarily show all fittings, etc., necessary to fit the building conditions. The location of outlets, apparatus and equipment shown on them are approximate. The Contractor shall be responsible for the proper location in order to make them fit with architectural details and instructions from the Engineer at the site.

1.3.9 Approval

Wherever required and necessary, equipment and apparatus data and information shall be submitted to the Engineer prior to the purchase, to ensure the adequacy and adaptability of the same.

1.3.10 Electrical Tests

Perform all field tests and trial operations, and conduct all field inspections (except final field inspection). Provide all labor, equipment, and incidental required for the tests. Engineer will witness all field tests and trial operations and will conduct final field inspections. The Engineer shall be given ample notice of the dates and times scheduled for tests, trial operations, and inspections which require the presence of the Engineer. All deficiencies found shall be rectified and work affected by such deficiencies shall be completely re-tested at the Contractor’s expense.

Test procedures shall conform to ASME, IEEE, and ANSI Standards, and to NEMA standard practices section on testing, as appropriate and applicable. Test shall include but are not limited to:

a) Inspect all devices and equipment for damage or maladjustment caused by shipment or installation.

b) Use calibrated torque wrench to assure that tightness of bolted bus joints is in accordance with manufacturer’s recommendations.
c) Remove wedges, ties, and blocks installed by the manufacture to prevent damage during shipment.

d) Verify maximum resistance to ground of grounding systems.

e) Perform functional/operational testing of all equipment.

f) Perform load testing of standby generator.

g) Perform ground rod resistance testing.

CAUTION: Changes of connection, insertion, and removal of instruments and meter must be performed in such a manner that the secondary circuits of energized current transformers are not opened, even momentarily.

(1) Test shall be performed as work progress and upon complete installation of each electrical system.

(2) Testing required herein shall be performed in the presence of the Engineer and at times duly arranged for in advance in accordance with the notification requirements.

(3) The Contractor at his own expense shall provide sufficient qualified personnel, time, and materials as necessary to perform all required tests.

(4) Failure of Work to pass required tests or otherwise not meet specified requirements as indicated by test records shall be sufficient reason for considering work as non-compliant and subject to disapproval or rejection entirely of respective work.

(5) Contractor’s failure to make required tests shall be considered same as for work not in compliance and shall be sufficient reason for rejecting entirely of Work not so tested. Testing of respective work not so tested by the Contractor may be performed by the Engineer or by duly qualified testing agency or other personnel retained by the Employer or the Engineer all at the Contractor’s risk and expense.

(6) Said expenses shall be subjected to recovery as they are accrued and by withholding same from monies due or which may become due to the Contractor under this Contract.

1.3.11 Preliminary Operation/Commissioning Checks

a) Place into operation all equipment provided and installed, except as specifically noted otherwise. Make all necessary adjustment to equipment to assure proper operation as instructed by the manufacturer of the equipment. Lubricate equipment prior to operation in accordance with the manufacturer’s instructions. Dry out all motors before operation as required to develop and maintain proper and constant insulation resistance.

b) Perform demonstration tests which shall include operating systems under various and varying conditions as necessary to prove that they operate and function as intended under this Contract.
c) When deemed by the Engineer as practical, feasible and not inhibitive nor disruptive to the Contractor’s effort, the Employer’s operating personnel shall be permitted to attend such tests or demonstration as will be helpful to their understanding of work for which they will be responsible when eventually turned over to them by the Contractor.

d) Demonstration tests shall be carried out for:

(1) Electrical equipment, individually and separately as installed.
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DIVISION 4 : DIESEL ENGINE GENERATOR SETS AND PARALLELING SWITCHBOARD

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1.1 GENERAL

Part 1 – General Requirements and Division 1 – Electrical Works General Requirements contain provisions and requirements essential to these Specifications, and shall apply to this Section, whether or not referenced herein.

The proposed generator will operate in parallel as one system with the 2 generator sets to be supplied by the existing Civil Work Contractor. To attain a satisfactory performance, all the required generator sets shall be of the same make and the same manufacturer. The existing Civil Work Contractor’s generator performance (connection, capacity, Hertz, Voltage, number of poles, AVR characteristics, etc.) and controlling method shall be examined if the need arises.

1.1.1 Scope of Work

The Work under this Division includes the design, supply, installation, testing and commissioning of all diesel engine generator sets, paralleling switchboard, associated equipment and cable works, indicated on the Drawings and in the Price Schedule, and includes:

a) All standby generating systems and associated;
   1) Exhaust piping systems
   2) Fuel distribution systems including day fuel tanks, piping, electric fuel pumps, etc
   3) Water cooled radiator heat exchangers
   4) Battery start-up systems

b) Total noise and vibration control systems conforming to Ministry of Environment guidelines

c) Paralleling switchboard with all necessary synchronizing relays and equipment

d) Automatic starting system

e) Power, control, instrumentation and grounding cables and conductors

f) Accessories and related work required to provide a complete and comprehensive working system in full compliance with these specifications.

1.1.2 Description of Operation for Generators Operating in Parallel

a) To understand the required start-up and operating sequence for generators operating in parallel as set out below, refer to Drawing Electrical Single Line Diagram’ Sheet No. E - 1001.

b) Status of circuit breakers for normal operation (mains healthy)

   1) 13.2 kV Switchgear
      (a) Mains incoming supply VCB – Closed
      (b) 132KV bus-tie VCB - closed
      (c) Feeder supplies to Trans (TR – 3) Closed
2) 480V, 3-Phase Paralleling Switchboard

(a) 2000A generator no. 1 incomer ACB – Open
(b) 2000A generator no. 2 incomer ACB – Open
(c) 2000A generator no. 3 incomer ACB – Open

c) Upon failure of the 13.2kV incoming mains supply, the following sequence of operations (1) to (6) shall occur automatically and within 10 seconds:

1) At 13.2 kV Switchgear mains incoming supply VCB, 132 KV Bus Tie VCB and TR – 3 VCB opens due to signal from mains failure relay and locks out.
2) Mains failure relay at 13.2 kV Switchgear signals both generators to start up.
3) At the 480V, 3-Phase Paralleling Switchboard generator no.1 incomer ACB closes
4) Generator no. 2 incomer ACB closes
5) Generator incoming supplies are synchronized across generator no.3 incomer ACB which then closes paralleling the two generator supplies on no-load (It shall be possible to select either generator as no.2 or no. 3 in the foregoing sequence).
6) At the 480V Switchgear the 2000A generator incoming supply ACB closes following stabilization of the paralleled generator supplies re-energizing the 480V bus and picking up all of the load.

d) Upon return of the 13.2kV incoming mains supply, the following sequence of operations shall occur automatically:

1) After a predetermined (by variable timer) period of between 0 and 10 minutes of stabilized incoming mains supply, both generators shall synchronize with the incoming mains supply across the mains incoming supply VCB. Once the three supplies are synchronized the mains incoming supply VCB shall close, paralleling the three supplies.
2) Following synchronization with the mains, the three generators shall gradually transfer the site load back to the mains supply. Upon completion of this action, the 480V generator incomer ACB shall open and lock out.
3) All generators shall continue running in parallel on no load for a period of 5 minutes after restoration of the mains supply, to allow them to cool down and also to ensure that the mains remains healthy.

1.2 PRODUCTS

1.2.1 Diesel-Generators and Auxiliary Equipment

1) General

Diesel-generators shall be silent type complete with accessories, auxiliary equipment and associated works as specified. Each generator shall consist of a diesel engine direct-coupled to an alternator with brushless excitation system. It shall include all necessary accessories and auxiliary equipment to provide a complete self contained unit.
capable of operating both independently and also in parallel with other units as indicated in the Drawings.

2) Equipment Rating and Capability

Each diesel-generator shall have a net standby rating capacity of not less than 1000 kW at 0.8 power factor. Both the engine and generator shall be capable of satisfactorily carrying a load 10 percent in excess of the net standby rated generating capacity at 0.8 power factor for a period of 2 continuous hours out of any 24 consecutive hours. All auxiliary equipment furnished shall be designed for standby duty at 110 percent of rated net capacity of the generating unit.

3) Mounting Base and Enclosure

The structural base for the diesel-generator shall be of the skid type and shall have adequate strength and rigidity to maintain alignment of the equipment mounted thereon without dependence on a concrete foundation. Provide at least four (4) vibration isolators to isolate the diesel-generator set from the concrete foundation. The isolators shall be specifically listed for this application and shall have a minimum deflection of 25 mm.

4) Diesel Engines and Accessories

a) The engines to be furnished under these Specifications shall be high-speed water-cooled diesel engines, and shall operate satisfactorily on a commercial grade of No.2 or No. 3 diesel fuel oil.

b) The diesel engine shall be of the vertical in-line or alternatively, “V” formation, multi-cylinder, four-cycle turbo supercharged type, with solid injection type fuel system. The maximum speed of the engine shall not exceed 1800 RPM. The lubrication system shall be of the wet type and removable. The crankshaft shall be fully counterbalanced with all bearing surfaces tocco hardened or equal and fitted with an acceptable viscous type vibration damper. There shall be one more main bearing than there is number of cylinders.

c) The complete diesel engine generator unit shall be free from critical and torsional vibration within the operating speed range. The engine is to be furnished complete with the following:

(1) Oil bath type air cleaner or cleaners for air intake system.

(2) Replaceable element type filter to be engine mounted in fuel line between fuel supply tank and fuel pump.

(4) Hydraulic governor or equal, to control engine speed within 3 percent speed regulation.

(5) Over-speed shutdown control for protection against over-speeding in case the governor fails to control the speed within proper limits for any reason.

(6) Heavy-duty electric starter for automatic starting.
d) A suitable engine-mounted instrument panel shall be provided and shall include:

(1) Lubricating oil temperature gauge
(2) Lubricating oil pressure gauge
(3) Water temperature gauge
(4) Engine hours-run meter
(5) Tachometer
(6) Operation failure indicators
(7) Emergency start and stop push buttons to over-ride the complete control system excluding engine and alternator safety interlocks.

e) The above panel shall have digital or analogue read-outs and contain the voltage regulator.

f) An audible and visible alarm system shall be provided to warn of both high water-jacket temperature and low lubricating oil pressure.

5) Engine Fuel System

The engine shall be provided with all necessary equipment, including piping, fittings, valves, filters, strainers and appurtenances.

6) Engine Starting

The engine shall be fitted with an axial type starter motor suitable for operation from a 24V battery. The motor shall disengage automatically when the engine fires.

An adjustable timing device shall be built-in with the starting system to prevent immediate consecutive operation of the starter motor, either by push-button or automatic remote starting device, in the event of the engine failing to fire. The timing device shall allow a lapse of 6 to 15 second between each successive restart of the starter motor, so as to allow sufficient time for the starter motor to automatically disengage itself from the engine’s cranking gear before an attempt to restart is made. All electrical equipment shall be suitable for operation on a 24-volt dc battery supply.

7) Generator Starter Battery and Battery Charger

Each Diesel Generator Set shall be provided with a 24Vdc starter battery and automatic charger unit complete with volt- meter and ammeter, to maintain the battery in a fully charged condition. The charger shall be provided with a manually operated control switch to give either float charge or boost charge facilities. The boost charger shall be capable of recharging the battery from completely discharged to a fully charged condition within 2 hours.

A battery charger failure protection alarm unit shall be fitted in each charger unit and arranged to operate in the event of the battery voltage falling below normal float level for a period of more than 30 minutes.
8) **Air Intake and Exhaust System**

The air intake and exhaust system for the engine shall include; piping, fittings and expansion joints necessary to interconnect equipment with the engine. Both the air intake and exhaust shall be piped from the engine to the outside of the building and shall be suitably protected against foreign bodies entering the system.

The arrangement of the air intake and exhaust system shall be subject to the approval of the Engineer.

9) **Cooling System**

The cooling system shall comprise a radiator of the forced air type with horizontal air discharge. The radiator fan shall be driven through multiple V-belts from an extended shaft connected to the engine crankshaft. The radiator shall be mounted in the structural skid and integrally piped into the cooling systems.

Cooling water shall be distilled.

**1.2.2 Alternator**

The alternator shall be directly coupled to the engine and shall be of the brushless type, self-excitation and self-regulating, with a rotating salient pole field system and incorporating the following features: It shall be wound for a 3-phase, 4-wire, star connected system with rated output 277/480 V 3 phase and frequency of 60 Hz with an earthed neutral and shall have a continuous rating.

All ends of the star connected winding including the neutral point shall be brought out and terminated in a main terminal box mounted on the stator frame. The box shall be suitable for the termination of the specified outgoing cables.

For the excitation system and automatic voltage regulator (A.V.R.), the alternator shall be designed for positive voltage build-up by permanent magnets being provided in the exciter field and with special windings to provide power via a silicon rectifier to the exciter field. Constant output voltage shall be achieved by provision of a transistorized A.V.R. to adjust the exciter field current to compensate for all normal variations and power factor. The A.V.R. shall incorporate the following features;

The voltage regulation shall be + or - 2.5 % of nominal from no-load to full-load at;

a) Any power factor within the range 0.8 lagging and unity

   (1) Between the hot and cold running conditions at the diesel-generator, and
   (2) for an engine speed variation of 4.5% between no-load and full-load.

b) After any load transients, the voltage shall be restored to within these limits in less than 3 seconds.

c) The line voltage waveform shall be limited to 2% harmonic content for all loads from 25% to 125%. It shall not exceed 5% for any other load conditions.
1.2.3  **Coupling**

A flexible rubber block coupling shall be fitted between the engine and alternator to provide the drive whilst also absorbing the transmission of shock loads.

1.2.4  **Generator Control Panel**

The Generator Control Panel shall be equipped with the following components as a minimum:

a)  Triple pole & neutral Air Circuit Breaker with shunt trip coil, where indicated in the Drawings.

b)  Voltage sensing relays and associated equipment.

c)  1 set - adjustable time delay (0 - 10 secs.) equipment to prevent set starting in the event of false mains failure or a momentary break in the supply.

d)  Voltmeter for all phases.

e)  Ammeter for all phases.

f)  Kilowatt-hour meter.

g)  Frequency meter of direct reading type.

h)  Battery chargers with ammeters, voltmeters and control switches (may alternatively be fitted in a separate cubicle).

i)  Power factor meter.

j)  Selector switch for "OFF", "TEST", "AUTO" and "MANUAL".

k)  Mains supply on indicator lamp.

l)  Mains on load indicator lamp.

m)  Alternators supply on indicator lamp.

n)  Alternator on load indicator lamp.

o)  Engine start push button with reset push-button.

p)  Engine stop push button.

q)  Mains failure simulation switch.

r)  "Fail to start" indicator lamp.

s)  Low oil pressure shutdown indicator lamp.

t)  High water temperature shutdown indicator lamp.

u)  Engine over-speed shutdown indicator lamp.
v) Generator circuit breaker tripped indicator lamp.
w) Alternator over voltage shutdown indicator lamp.
x) Fault reset push-button.
y) Alarm acknowledgement push button (to cancel both audible & visible alarms)
z) All necessary internal wiring and interconnections.

aa) Non-ferrous gland plate and interface terminal connection blocks for termination of all incoming /outgoing cables.

bb) All other control devices etc. as required for the operation of the plant and to provide facilities covered elsewhere in the specifications.

The control cubicle shall be constructed of heavy gauge sheet steel with hinged and gasketed front and rear access doors (doors fitted with automobile door handle lock). Where possible all components shall be constructed of non-hygroscopic and non-inflammable materials.

The control cubicle shall be fitted with an anti-condensation heater and controlling thermostat.

1.2.5 Paralleling Switchboard

1) Equipment Ratings

The paralleling switchboard shall be rated for operation with emergency bus rated and configured as shown on the contract drawings.

2) Equipment Construction

Switchboard shall be a rigid, freestanding, metal enclosed structure, designed for front and rear access, with generator and load connections entering the structure. Each section of the switchboard shall be constructed with a minimum 12-gauge steel sheet metal framework.

Each section of the paralleling system shall be listed and labeled under the requirements of UL 891, including all covers, barriers, and supports. Breakers and individual control sections shall be isolated from each other by metal or insulating barriers.

All wiring shall be 600 volt rated, and sized as required. Each wire and device function shall be suitably identified by permanent label.

The system emergency bus shall be silver plated copper with bolted joints for all three phases, with a full sized neutral, and a 6mm x 50mm ground bus extending through all sections and shall not exceed 1,000 amps/square inch. Copper bus shall be braced for peak symmetrical current available from all generator sets plus motor contributions, to 80,000 amps RMS minimum.

The framework and all other sheet metal components of the system shall be primed with a rust-inhibiting primer, and finished with two coats of satin finish ANSI 61 gray enamel.
All door mounted control devices shall be industrial type oil-tight with contact ratings a minimum of twice the maximum circuit capacity they are controlling. Toggle switches and other light duty control devices are not acceptable. Indicator lamps shall be high intensity LED type devices. Indicator lamp condition (on or off) shall be easily visible in bright room lighting conditions.

All field interconnecting wiring shall be sized as specified by system manufacturer (minimum 2.0mm² copper) and shall be stranded.

Note space available and access requirements for the paralleling equipment, and provide equipment that will fit into the space allowed with adequate provision for operation and maintenance.

1.2.6 Control Battery and Accessories

1) Control Battery

Provide one storage battery for d.c. control power requirements. Battery shall be suitable for switchboard operation, alarm system and related control functions. Battery shall not be used for engine cranking. It shall be lead-acid, maintenance-free, sealed-for-life type.

2) Battery Racks

Include battery racks suitably constructed for the battery provided. Racks shall be of substantial construction and arranged in an approved convenient and accessible manner. Construct racks of securely braced welded steel frames. Racks shall have steel rails with a top covering of acid-or alkali-resistant rubber or plastic. Permanently attach acid-resistant rubber or plastic numerals not less than one inch in height to the rack in a position numerals not less than one inch in height to the rack in a position to readily indicate the associated cell. All structural parts of the racks shall have not less than two coats of an approved acid-resistant paint or varnish.

3) Battery Charger

Silicon diode type, adjustable, self-regulating, current limiting, and suitable for wall mounting. Charger shall have input rating of 240 volts, single-phase 60-hertz. Output voltage shall be variable between approximately 23 and 28 volts, d.c. Voltage regulation of the charger shall be 0.5 percent maximum from 0 to 100 percent load. Charger shall be complete with output voltage potentiometer, line switch, equalizing charge switch and timer, reverse power protection, d.c. ammeter, d.c. voltmeter, grounding terminal, and enclosing steel cabinet treated to resist corrosion.

1.2.7 Cables & Wiring

Provide all electrical cables, wiring, wiring accessories and containment required to produce a complete and comprehensive working system as described in the Drawings and Specifications.

1) Conductors

All conductors shall be of high conductivity copper. Conductors in power cables of 3.5mm² and smaller may be solid, all other conductors shall be stranded.
2) **Insulation**

Insulation shall be rated for 600 volt service.

3) **Connectors and Terminals**

Connectors and terminals shall be designed and approved for use with the associated conductor material, providing a uniform compression over the entire contact surface. Compression terminal lugs shall be used on all stranded conductors.

4) **Flexible Metallic Conduit and Fittings**

Flexible metallic conduit and fittings shall be used between rigid metallic conduit and generator terminal box to prevent transmission of vibration from generator to conduit system. Flexible conduit and fittings shall be steel, zinc-coated in dry locations and steel, zinc-coated with outer plastic liquid tight jacket in wet locations.

### 1.3 EXECUTION

#### 1.3.1 Factory Tests and Inspections

1) **Alternator Factory Tests**

Temperature tests on the alternator shall be performed by the manufacturer of that equipment in his own plant prior to installation on the generator skid. Alternator tests shall include insulation resistance, dielectric resistance, open circuit saturation, short circuit saturation, zero power factor, 60 Hz saturation curve, direct-axis transient reactance, negative sequence reactance tests. All test data shall be submitted to the Engineer. Calculations of the sub-transient reactance using test values shall be included in the test report.

2) **Diesel-Generator Factory Tests**

   a) Factory tests on each diesel-generator unit shall include, but are not limited to:

      (1) Hydrostatic test on water-jackets to demonstrate that the water seals and water jackets are watertight. Test report shall indicate pressure at which test was made and the results.

      (2) Generating unit shall be operated continuously for a period of not less than 8 hours. During this time it shall operate for not less than one hour at half load, one hour at three-quarters load, one hour at full load, and two hours at 110 percent of rated load, at unity power factor. If it becomes necessary to stop the machine during this period, the whole 8-hour test shall be repeated. During the test, the following data shall be recorded at the start, at 15 minute intervals, and at the end of each load run: Fuel consumption, exhaust temperatures, jacket water temperatures, lube oil temperatures and pressures, crankcase vacuum, and any other important data.

   b) Confirm smokeless combustion, adequacy of capacity of engines and complementary equipment, and freedom from undue strain.
c) Upon completion of the tests check oil for presence of metal filings and/or water.

d) Provide the necessary load bank and install all temporary instrumentation, piping, and electrical wiring and make all electrical connections required for the generating unit tests.

3. Test Re-runs

If the specified performance is not indicated by these tests, make such adjustments and changes as necessary and conduct additional tests as required, to further check the performance of the equipment. Contractor shall bear all costs of such additional tests, including cost of fuel used.

1.3.2 Installation

1) Generator Switchboard

Receive, unload, store if necessary, install and connect the generator switchboard as indicated in the drawings and specifications. Floor mounting channels shall be provided and installed in the concrete floor slab in accordance with the switchgear manufacturer's drawings and instructions, and as indicated on the drawings.

2) Batteries and Chargers

Install in accordance with manufacturer's instructions. If batteries are to be stored during the construction period, follow manufacturer's instructions as to charging and protection from freezing.

1.3.3 Field Tests and Inspections

Upon completion of the installation and general testing as specified under Division 1 – Electrical Works General Requirements, notify the Engineer in writing that the generating units and auxiliary equipment are ready for final field tests. These tests will be witnessed by the Engineer or his authorized representative, and shall include the following:

1) A test to assure proper functioning of the overspeed trip.

2) An individual test of each pressure and temperature alarm switch.

3) Demonstrate automatic start-up, synchronizing and load pick up for a simulated mains failure. Confirm operation as set out under Clause 4.2.1 of this specification.

4) Demonstrate automatic transfer of load back to mains supply following reinstatement of mains supply.
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DIVISION 1: FACILITIES FOR THE ENGINEER

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</table>
DIVISION 1: FACILITIES FOR THE ENGINEER

1.1 TRANSPORT

1.1.1 Vehicles

a) The Contractor shall maintain, comprehensively insure, service, and clean the existing vehicles as detailed for use by the Engineer and their staff.

b) The costs of insuring, taxing, licensing, maintaining, servicing, cleaning and all consumables such as fuel, lubricants, tires etc. and spare parts and drivers will be deemed to be included in the rates provided by the Contractor in the Bill of Quantities. The salaries of the drivers shall include work provision for overtime.

1.1.2 Vehicles for Engineer and Staff

a) The number of existing vehicles to be maintained by the Contractor within the given number of months during the project implementation as well as during the Defects Liability Period is shown in the Price Schedule.

While the Contract of the existing Civil Work Contractor has been enforced or until the issuance of its Certificate of Final Payment, the maintenance of the existing vehicles to be used by the Engineer and Staff shall be chargeable against the existing Civil Work Contractor. The Engineer shall give formal notification to the Contractor as to when will be the start of its maintenance.

b) Maintenance and servicing of the vehicles shall conform to the requirements and recommendations of the vehicle manufacturer.

1.1.3 Standby Vehicles

In the event that vehicles are not available for use by reason of their being under repair, broken down or being serviced, the Contractor shall supply equivalent substitute vehicles until such time as the original vehicles are back in use.

1.1.4 Handing Over to Employer

After the end of the Defect Liability Period or when a vehicle is no longer required by the Engineer for the purpose of the Contract, the Contractor shall fully service and rehabilitate the vehicle and hand it over to the Employer. Once handed over to and accepted by the Employer, the Contractor's obligations with regard to the vehicle shall cease.

1.1.5 Drivers

Licensed competent drivers with previous experience in driving in and under prevailing conditions on a major civil engineering construction site shall be provided for all vehicles.

Drivers shall:

a) read, write and speak English;

b) be available and able to regularly work any hour on any day of the week;
c) be engaged under working conditions that have the requisite flexibility to meet demands for their services at any time by the Engineer for any purpose under the Contract.

d) have a Professional Driver’s License issued by Land Transportation Office.

The Contractor shall manage and monitor the performance of drivers to ensure the provision and maintenance of drivers with a high level of skill and a demonstrated ability to drive efficiently and safely. Drivers not meeting these criteria will be promptly replaced by the Contractor when so directed by the Engineer.

1.2 OFFICES

1.2.1 Location and Design

a) The Contractor shall maintain the existing Engineer’s field office located within the Laguindingan Site.

b) The Contractor is responsible for all costs involved in providing maintenance of the facilities and this should be indicated against the appropriate items in the Bill of Quantities.

1.2.2 Services and Maintenance

a) The Contractor shall service and maintain the existing offices and their grounds in good repair and pay all cost involve within the required number of months during the Project Implementation as well as during the three (3) years Defect Liability Period as indicated in the Price Schedule.

While the Contract of the existing Civil Work Contractor has been enforced or until the issuance of its Certificate of Final Payment, the maintenance of the existing Office to be used by the Engineer and Staff shall be chargeable against the existing Civil Work Contractor. The Engineer shall give formal notification to the Contractor as to when will be the start of its maintenance.

Services to be provided are the supply or provision of:

(1) potable water,
(2) hot and cold water for domestic purposes,
(3) electricity and air conditioning,
(4) toilet supplies such as soap, toilet paper, etc.,
(5) a regular and effective garbage collection and disposal system, and
(6) telephone and facsimile lines.

b) Potable water for the Engineer's offices shall be provided as and when it is required up to 2.5 liters per day for each staff member. Potable water shall mean water of a quality at least equivalent to commercially available mineral water in the Philippines.
c) The Contractor shall arrange for the cleaning of the offices on a daily basis, including the toilet and shower areas, and shall ensure that at all times lavatory paper and disinfectant are available in the lavatories, soap and paper towels in the toilet area, and clean dishcloths and washing-up liquid in the kitchen. Appropriate hand cleaners, solvents and the like shall be provided in dispensers approved by the Engineer for the ready removal of grease, grime, bituminous materials etc.

1.2.3 Office Furnishings and Equipment

All furniture and equipment shall be maintained by the Contractor, in good order. When all furniture and equipment will no longer be used by the Engineer for the purposed of the Contract, all furnished equipment and furniture shall become the property of the Employer.

Refer to Appendix 1 for the list of the required Office/Communication Equipment and Consumable Stores for the Engineer’s Field Office.

1.2.4 Disposal on Completion

When the offices and dwellings are no longer required for the purposes of the Contract, the Contractor shall turn-over the facilities to the Employer.

1.2.5 Security

The Contractor shall be responsible for the security of the offices and the contents therein and shall provide suitably equipped and trained watchmen for each office, to ensure the security of the offices and contents is maintained 24 hours a day.

1.3 ACCOMMODATION

1.3.1 Services and Maintenance

a) The Contractor shall service and maintain the existing accommodation and grounds in good repair and pay all cost involve within the required number of months during the Project Implementation as well as during the three (3) years Defect Liability Period as indicated in the Price Schedule.

While the Contract of the existing Civil Work Contractor has been enforced or until the issuance of its Certificate of Final Payment, the maintenance of the existing accommodation to be used by the Engineer and Staff shall be chargeable against the existing Civil Work Contractor. The Engineer shall give formal notification to the Contractor as to when will be the start of its maintenance.

Services to be provided are the supply or provision of:

(1) potable water, as described in Section 1.2.2 above,

(2) hot and cold water for domestic purposes,

(3) electricity and air conditioning

(4) toilet supplies such as soap, toilet paper, paper towels, disinfectant, toilet cleaning liquids and detergents, etc.

(5) a regular and effective garbage collection and disposal system, and
(6) telephone, internet and facsimile lines

The Contractor shall provide monthly operating expenses including cost for services and minor repair of the existing 3 units of landlines.

(7) Maintenance of existing four (4) units of cellular phone (to include pre-paid cellular phone cards for duration indicated in the Price Schedule)

b) Potable water for staff accommodation is to be provided as and when required up to 5 liters per day for each occupant of such accommodation.

c) Maintenance and cleaning of the accommodation and the surrounding areas shall be carried out on a daily basis by suitable staff provided by the Contractor.

1.3.2 Furnishings and Equipment

The maintenance, in good order, of the existing furniture and equipment shall be the responsibility of the Contractor.

Refer to Appendix 1 for the list of the required Consumable Stores for the Engineer’s Quarters.

1.3.3 Refurbishment on Completion

When the accommodation is no longer required for the purposes of the Contract, the Contractor shall, on the instructions of the Engineer:

a) Refurbish, clean and repaint the interior and, where appropriate, the exterior of the designated accommodation to the standard accepted at occupying the accommodation by the Engineer and hand them over to the Engineer.

b) Refurbish, service and repair as necessary all services system.

c) Refurbish all furniture, etc. and overhaul all equipment.

1.3.4 Provision of Accommodation

Until the accommodation specified in Section 1.3.1 of this Division is available for occupation, the Contractor shall provide at his cost accommodation, laundry and other reasonable living expenses.

1.3.5 Security

The Contractor shall be responsible for the security of the accommodation and the contents therein and shall provide suitably equipped and trained watchmen for the various accommodation units to ensure the security of the accommodation and contents is maintained 24 hours a day. He shall provide at least two (2) security guard per shift to secure the compound on two (2) shifts.
1.4 ASSISTANCE TO THE ENGINEER

1.4.1 Communications

The Contractor shall maintain in perfect working order during the duration specified in Appendix 1 all communication equipment as detailed therein. When the communication equipment is no longer required for the purposes of the Contract, the Contractor shall hand them over to the Employer.

1.5 PROGRESS PHOTOGRAPHS

The Contractor shall supply to the Engineer technically perfect color photographs of the Works taken in such a manner and at such a time or times as the Engineer shall direct. The photographs shall be in a 3.5” x 5” format. Wherever possible, a high-resolution camera shall be used, and clarity and depth of focus are the principal objectives. The Contractor shall provide the electronic copies in CD, properly labeled with information on dates taken, and six prints of each photograph. The electronic copies in CDs and two sets of prints shall be housed in a good-quality photograph album or CD cases suitable for record purposes, and the remaining four sets of the prints shall be stored in photo wallets. The Engineer shall then determine which, if any, of the photographs are to be reproduced at larger sizes and in what numbers, and shall advise the Contractor accordingly. The copyright of all photographs is retained by the Employer. All photographs shall be clearly identified giving the Project Name, the number of the photograph, the date taken and the view depicted.

1.6 AS-BUILT DRAWINGS AND FINAL PROJECT REPORT

a) The Contractor shall progressively prepare As-Built Drawings covering the whole of the Works and a final Project report. As-Built Drawings shall be based on the Drawings for implementation.

b) Amendments and changes to the Drawings shall be recorded on a set of Drawings kept specifically for this purpose. The Contractor, upon completion, shall produce from them a final, complete set of As-Built Drawings depicting accurately the location, dimensions and nature of the completed Works. They shall also show the sequence, dates and test results of equipment supplied and installed.

c) The following are to be provided:

(i) Full size (A1) paper print 5 sets
(ii) Reduced size (A3) paper prints from above 5 sets
(iii) Reproducible copies A1 and A3 on high quality, dimensionally stable plastic film 1 set each

d) The Contractor shall prepare As-Built Drawings progressively throughout the Works.

e) Payment for any item in the Price Schedule in excess of 90% of the value of that item prior to deduction of retention monies will not be made until the Contractor has provided approved As-Built Drawings associated directly or indirectly with the item.

f) Five (5) sets of draft copies of c(i) above shall be submitted to the Engineer for approval within 28 days with the Contractor submitting a request for payment claiming 90% of any item or for all or any part of the Works. Within a further 28 days, the Engineer shall return the drawings, either approved or with a statement as to what is required before
approval can be given. On incorporation of the Engineers’ statement, which must be done within a further 28 days, the Contractor shall provide the prints and copies as stated in the above-mentioned items c(i) to c(iii). The reproducible drawings shall be properly filed in the existing vertical drawing filing cabinets. The paper copies shall be bound as separate, appropriately titled volumes.

1.7 **SHOP DRAWINGS**

a) The Contractor shall prepare and submit to the Engineer, for approval, shop drawings as required by the Specification or when instructed to do so by the Engineer.

b) The shop drawings shall be submitted in a format and scale to be agreed with the Engineer on site. The drawings must show, clearly, all the details of the works as required or instructed and shall be fully annotated in the English language and dimensioned.

c) The shop drawings shall be submitted complete with any relevant Specification, calculations and any other necessary relevant information.

d) The Contractor shall submit three (3) copies each of all shop drawings to the Engineer in sufficient time for the Engineer to review and approve or reject the drawings, having due consideration as to when the particular works are to be carried out. For planning and programming purposes the Contractor shall allow a minimum period of 28 days for the Engineer’s review, approval and/or further instructions in respect of each shop drawings submission.

e) When a shop drawing is approved, the Contractor shall submit three (3) copies of the approved drawing to the Engineer to be used for on-site inspections and retained for record purposes.

f) Should any of the shop drawings be rejected then the Contractor shall make the necessary amendments and resubmit them to the Engineer for approval. The Contractor is responsible for amending and resubmitting the shop drawings until they are approved by the Engineer.

g) Work in respect of items requiring the production and submission of shop drawings shall not commence until the shop drawings have been approved by the Engineer. Any works commenced prior to such approval shall be at the Contractor’s risk.

h) The Contractor will be held liable should the Works be delayed by late or inadequate submission of shop drawings or by abortive work caused by work being done in advance of approval of the shop drawings.

i) The cost of preparing, submitting and resubmitting, where necessary, the shop drawings shall be borne by the Contractor.

j) Approval by the Engineer of the shop drawings, shall not relieve the Contractor of any of his responsibilities under the Contract.

* * * * *
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DIVISION 2: CONTRACTOR'S SITE ESTABLISHMENT

1.1 OFFICES, YARDS, WORKSHOPS, ETC

1.1.1 Contractor’s Responsibility

   a) The Contractor is entirely responsible for the provision, erection, maintenance and removal on completion of the whole of the Works his offices, yards, workshops, stores, housing, labour camp, services, recreation facilities and the like at designated location to be assigned by the Engineer.

   b) Where the Contractor intends to use the assigned areas, he shall submit to the Engineer for approval detailed plans of his intended site establishment, including arrangements for access, drainage, sewerage and the containment of pollutants.

   c) Should any area on the Site allocated to the Contractor for his use be insufficient for his purposes, it shall be the responsibility of the Contractor to provide such additional area outside the Site at his own cost.

   d) The contractor shall provide a qualified nurse and various kinds of medicines including First-aid kit and paraphernalia in his site office throughout the construction period so that every person related to the Contract including the staff of the contractor, the sub-contractors, the suppliers, etc., can be given the first medical aid when required.

      The nurse and the first-aid assistant shall also be available to the staff of the Employer and the Engineer, and their family members without any cost.

1.1.2 Security

   a) The Contractor is responsible for the security of his offices, yards, workshops, storage areas, work areas and the like, and shall provide whatever walls, fencing, gates, guards and access-control measures as are necessary to provide such security.

   b) Where the construction of the Works requires the breaching of the airport's perimeter or internal walls or fencing, the Contractor shall provide temporary security fencing or walls of a standard acceptable to the Engineer.

   c) Where there are other contractors on Site, the Contractor shall ensure that all security arrangements are properly coordinated. The Contractor shall comply in all respects with regard to the security of the airport, including the provision of identity cards for all vehicles and persons engaged on or about the construction of the Works or the supervision thereof.

1.1.3 Reinstatement of Site

Upon completion of the Works, the Contractor shall:

   a) remove from Site all his equipment, workshops, stores, offices, accommodation, and the buildings, except those required to discharge his obligations during the Defects Liability Period;
b) demolish and dispose of all foundations, ramps, inspection pits and the like;

c) seal off service connections;

d) clear the Site of all debris and waste material of any kind;

Once the Contractor's obligations with regard to the Defects Liability Period have been discharged, the remaining site establishment shall be removed forthwith and the area reinstated as described above.

1.2 TEMPORARY SERVICES

1.2.1 Electrical Power for Construction and Commissioning

The Contractor shall provide all power requirements for the execution of the Works on and in vicinity of the Site, in his store yards, workshops and like areas from the electricity authority supply network.

The Contractor shall provide adequate power generation capacity necessary to maintain continuity and quality of the Works and ensure continuous uninterrupted supply to accommodation and offices to the Engineer and their personnel.

The supply of electricity by the Contractor shall include all fuel, servicing, maintenance and repairs to ensure compliance of the Works with the requirements of the Contract and power supply as indicated above.

The Contractor is responsible for liaising with all relevant authorities, with regard to the supply of electricity, and removing, clearing away and making good all temporary connections on completion of the Works to the satisfaction of the relevant authority.

1.2.2 Water for Construction and Commissioning

1.2.2.1 Water Supply

a) The Contractor shall provide water required for the construction and commissioning of the Works, including a continuous supply of clean water required for offices and accommodation. He may, should he so wish, make arrangements for water to be supplied in whole or in part from any national or local water supply organization or from the existing civil work contractor. However, in the event that such a water supply proves inadequate or is expected to fail then the Contractor must immediately take action to provide water for domestic purposes by providing suitable sterile containers and using sterile water tankers to transport water.

b) Water to be supplied for domestic purposes shall not constitute a health hazard, shall not stain, mark or discolor clothing regularly washed in such water, and shall be subject to frequent testing to ensure that this remains so. The Contractor shall arrange for weekly testing of both the water at source and the water at the point of use and at such locations and times as the Engineer shall advise. The tests shall determine the presence of parasites, the level of pathogens, the type and concentration of dissolved solids, and the presence of any other contaminants. The test results shall be returned directly to the Engineer and shall be accompanied by a certificate from the testing laboratory which includes a narrative assessment of the quality of the water and its suitability for domestic purposes.
c) The Contractor is responsible for liaising with all relevant authorities, with regard to the supply of water, and removing, clearing away and making good to all temporary connections on completion of the Works to the satisfaction of the relevant authority and the Engineer.

1.2.2.1 Potable Water Supply

a) Potable water is water which is safe and suitable for drinking without receiving any further form of treatment.

b) Except where the Contractor can demonstrate by the regular testing of the water by an approved laboratory that the piped supply of domestic water at the accommodation units and office taps is consistently potable, then he is to supply potable water bottled by a reputable and registered water supply company.
APPENDIX 1

OFFICE/COMMUNICATION EQUIPMENT AND CONSUMABLE STORES FOR THE ENGINEER

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<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Office Equipment for Engineer's Office</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Computer Laptop, Intel Core i5 Processor, 2.26 GHz, 4GB DDR3 Memory, 14.0 LED display, with dedicated graphics 1 GB, Genuine Windows 7 Professional 32bit, and Microsoft Office 2010 Professional with anti-virus</td>
<td>3 nos.</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Communication Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Latest Model of cellular mobile phone, tri-band complete with accessories including adaptor for AC and DC (to include pre-paid cellular phone cards for the entire implementation of the Project plus DLP.)</td>
<td>3 no.</td>
</tr>
<tr>
<td>3.0</td>
<td><strong>Consumable Stores for Field Office and Quarters</strong></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td><strong>Consumable Stores for Field Office and Quarters during Implementation</strong> (reckoned from the date the field office and quarters have been turnover to DOTC by the existing civil work contractor/receipt of Certificate of Final Acceptance up to ANSSF Contractor’s receipt of Certificate of Operational Acceptance (which is the start of its DLP)</td>
<td></td>
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<tr>
<td>3.1.1</td>
<td>Cartridge (Computer Printer / Ink) (Colored)</td>
<td>2 pcs</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Cartridge (Computer Printer / Ink) (Black)</td>
<td>4 pcs</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Compact Disk (DVD rewritable)</td>
<td>15 pcs</td>
</tr>
<tr>
<td>3.1.4</td>
<td>Double Clip, Medium and Large</td>
<td>3 boxes</td>
</tr>
<tr>
<td>3.1.5</td>
<td>Bond Paper (A4 size)</td>
<td>10 reams</td>
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<tr>
<td>3.1.6</td>
<td>Bond Paper (A3 size)</td>
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<td>3.1.7</td>
<td>Bond Paper, Long</td>
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<tr>
<td>3.1.8</td>
<td>Yellow Pad</td>
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<tr>
<td>3.1.9</td>
<td>Laser Printer (Toner)</td>
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<td>Item</td>
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<td>3.1.10</td>
<td>Carbon Paper</td>
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<td>3.1.11</td>
<td>Scotch Tape, 19 mm. x 60 m.</td>
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<tr>
<td>3.1.12</td>
<td>Masking Tape, 19 mm.</td>
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</tr>
<tr>
<td>3.1.13</td>
<td>Magic Tape, 19 mm.</td>
<td>5 rolls</td>
</tr>
<tr>
<td>3.1.14</td>
<td>Batteries &quot;Energizer&quot; (Assorted Sizes)</td>
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</tr>
<tr>
<td>3.1.15</td>
<td>Pens (Ballpen), Assorted Color</td>
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</tr>
<tr>
<td>3.1.16</td>
<td>Pencil Lead, No. 5</td>
<td>1 tube</td>
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<td>3.1.17</td>
<td>Paper Clip (Plastic Coated)</td>
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<td>3.1.18</td>
<td>Fastener (Plastic Coated)</td>
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<td>3.1.19</td>
<td>Eraser (Ink, Pencil)</td>
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<td>3.1.20</td>
<td>Staple Wire, No. 35</td>
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<td>3.1.21</td>
<td>Staple Wire, No. 10</td>
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<td>3.1.22</td>
<td>Cutter Blade</td>
<td>1 box</td>
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<td>3.1.23</td>
<td>Glue, 130 grams</td>
<td>2 bottles</td>
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<td>3.1.24</td>
<td>Correction Fluid, 15 ml.</td>
<td>6 bottles</td>
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<tr>
<td>3.1.25</td>
<td>Brown Envelope, Long</td>
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</tr>
<tr>
<td>3.1.26</td>
<td>Brown Envelope, Short</td>
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</tr>
<tr>
<td>3.1.27</td>
<td>Folder, Long</td>
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</tr>
<tr>
<td>3.1.28</td>
<td>Folder, Short</td>
<td>3 dozen</td>
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<tr>
<td>3.1.29</td>
<td>Colored Pencil, 12' s</td>
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</tr>
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<td>3.1.30</td>
<td>Floor Mop (Rug)</td>
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<tr>
<td>3.1.31</td>
<td>Pentel Pen (Assorted Color)</td>
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<tr>
<td>3.1.32</td>
<td>White Board Marker (Assorted Color)</td>
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</tr>
<tr>
<td>3.1.33</td>
<td>Letter Envelope, White (Long)</td>
<td>1 dozen</td>
</tr>
<tr>
<td>3.1.34</td>
<td>Letter Envelope, Airmail (Long)</td>
<td>1 dozen</td>
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<td>Paste in Plastic Tube</td>
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<td>Memory Stick for Digital Camera (4 Gb)</td>
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<td>Cross Section Paper</td>
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<td>Sign Pen (assorted Color)</td>
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<td>Field Book</td>
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<td>Toilet Deodorant</td>
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<td>Fluorescent Lamp, 40 watts</td>
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<td>Floor Wax – 250 grams</td>
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<td>Toilet Paper (2 - ply)</td>
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<td>3.1.48</td>
<td>Rubbing Alcohol</td>
<td>5 bottles</td>
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<td>Toiler Cleanser (Duck)</td>
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<td>Mineral Water (5 gallons/container)</td>
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<td><strong>Living Quarter</strong></td>
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<td>Dutch Cleanser</td>
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<td>Scrubbing Pad</td>
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<td>Toilet Paper (2 Ply)</td>
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<td>Bath Soap (Family Size)</td>
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<td>Laundry Soap (Bar)</td>
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<td>Insect Spray (Aerosol, 100 ml.)</td>
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<td>LP Gas, 11 kg.</td>
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<td>Wiping Rags</td>
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<td>Replacement of First Aid Kit</td>
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<td>Flourescent Lamp, 20 watts</td>
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<td>Lysol/Muriatic Acid</td>
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<td>Mineral Water (5 gallon/container)</td>
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## Price Schedule 6: SUMMARY

### (4) SUBSTATION HIGH VOLTAGE AND LOW VOLTAGE ELECTRICAL EQUIPMENT

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<th>Local Cost Component (Pesos)</th>
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Total Price (To Grand Summary)

Name of Bidder: __________________________
Signature of Bidder: __________________________
Date: __________________________
### Price Schedule 6: SUMMARY

#### (6) GENERAL REQUIREMENTS

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<th>Local Cost Component (Pesos)</th>
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Total Price (To Grand Summary)

Name of Bidder: ___________________________  Signature of Bidder: ___________________________  Date: ___________________________
### Price Schedule 6: SUMMARY

#### (5) FLIGHT TEST COMMISSIONING (ILS/DME, DVOR/DME, ATC System and Aeronautical Ground Lighting System)

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Name of Bidder: __________________________
Signature of Bidder: __________________________
Date: __________________________
## Price Schedule 1: Goods Manufactured Outside the Purchaser's Country, to be Imported

### (2) ELECTRICAL WORKS - AIR NAVIGATION SYSTEM (ANS) & AERONAUTICAL GROUND LIGHTING SYSTEM (AGLS)

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<th>Description</th>
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<th>Delivery Date as Defined by Incoterms</th>
<th>Quantity and Physical Unit</th>
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**Total for 2.1 UNDERGROUND CONDUIT**

Sub Total "2.1" - UNDERGROUND CONDUIT
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Name of Bidder: __________________________
Signature of Bidder: __________________________
Date: __________________________
## Price Schedule 6: SUMMARY

### (1) AIR NAVIGATION SYSTEM

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**Total Price (To Grand Summary)**

---

Name of Bidder: ____________________________  
Signature of Bidder: ________________________  
Date: ____________________________
CONFIDENTIAL

PROCUREMENT OF AIR NAVIGATION SYSTEM
AND SUPPORT FACILITIES SUPPLY PROJECT

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The Procurement for this Project to be financed by Loans from the Export-Import Bank of Korea from the resources of the Economic Development Cooperation Fund (EDCF) of the Republic of Korea, hereinafter and throughout these documents referred to as EDCF, is carried out in accordance with the general principles and procedures laid down in the latest Guidelines for Procurement under EDCF Loans (hereafter called Guideline for Procurement under the EDCF Loan).

This Bidding Documents have been prepared for the Department of Transportation and Communications for the Procurement of Laguindingan Air Navigation System and Support Facilities Supply Project through competitive bidding (CB) among Korean Firms.

The EDCF Standard Bidding Documents for the Procurement of Goods using Single Stage Two Envelope Bidding Procedure is used as basis in the preparation of this Bidding Documents with modifications to suit project requirements as incorporated in Section II. Bidding Data Sheet and Section VIII. Special Conditions of Contract.
# Abbreviations

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A. General

1. Scope of Bid

1.1 The Purchaser indicated in the Bidding Data Sheet (BDS), issues these Bidding Documents for the supply of Goods and Related Services incidental thereto as specified in Section VI, Schedule of Requirements. The name, identification, and number of lots of this Competitive Bidding (CB) procurement are specified in the BDS.

1.2 Throughout these Bidding Documents:

(a) the term “in writing” means communicated in written form (e.g. by mail, e-mail, fax, telex) with proof of receipt;

(b) if the context so requires, “singular” means “plural” and vice versa; and

(c) “day” means calendar day.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called “Borrower”) specified in the BDS has applied for or received financing (hereinafter called “funds”) from the Export-Import Bank of Korea (hereinafter called “the Bank”) from the resources of the Economic Development Cooperation Fund (hereinafter called “EDCF”) of the Republic of Korea toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract for which these Bidding Documents are issued.

2.2 Payments by the Bank will be made only at the request of the Borrower and upon approval by the Bank in accordance with the terms and conditions of the financing agreement between the Borrower and the Bank (hereinafter called the Loan Agreement), and will be subject in all respects to the terms and conditions of that Loan Agreement. The Loan Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, to the knowledge of the Bank, is prohibited by decision of the Bank. No party other than the Borrower shall derive any rights from the Loan Agreement or have any claim to the funds.

3. Fraud and Corruption

3.1 It is the Bank’s policy to require that Borrowers (including beneficiaries of EDCF), as well as bidders, suppliers, contractors, and consultants under Bank-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuit of this policy, the Bank:

(a) defines, for the purposes of this provision, the terms set

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1 in this context, any action taken by a bidder, supplier, contractor, or a sub-contractor to influence the procurement process or contract execution for undue advantage is improper.
forth below as follows:

(i) “corrupt practice”\(^2\) is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(ii) “fraudulent practice”\(^3\) is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) “collusive practice”\(^4\) is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

(iv) “coercive practice”\(^5\) is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(v) “obstructive practice” is

(a) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under sub-clause 3.1 (e) below.

(b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive or coercive practices in competing for the Contract in question;

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\(^2\) “another party” refers to a public official acting in relation to the procurement process or contract execution. In this context, “public official” includes KEXIM staff and employees of other organizations taking or reviewing procurement decisions.

\(^3\) a “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

\(^4\) “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non-competitive levels.

\(^5\) a “party” refers to a participant in the procurement process or contract execution.
(c) will cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of the loan engaged in corrupt, fraudulent, collusive or coercive practices during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to the Bank to remedy the situation;

(d) will sanction a firm or individual, including declaring them ineligible, either indefinitely or for a stated period of time, to be awarded a the Bank-financed contract if it at any time determines that they have, directly or through an agent, engaged, in corrupt, fraudulent, collusive or coercive practices in competing for, or in executing, the Bank-financed contract; and

(e) will have the right to require that a provision be included in Bidding Documents and in contracts financed by a EDCF, requiring bidders, suppliers, contractors and consultants to permit the Bank to inspect their accounts and records and other documents relating to the Bid submission and contract performance and to have them audited by auditors appointed by the Bank.

3.2 Bidders (including all parties/partners, and the Representative in case of a Joint Venture or Consortium/Association) shall submit the original signed form (with certificate of corporate seal registration) of the “Anti-Corruption and Anti-Malpractice Declaration” as attached in the last page of Section IV (Bidding Forms) to the Bank (see the address specified in the BDS) by mail or in person at or before the Deadline for bid submission in the BDS and submit a copy of the original signed form to the Purchaser along with the Bid upon the submission of the Bid.

Bidders who fail to submit the original signed form to the Bank and to include the copy of it in the bid, as set forth above, shall not be substantially responsive subject to ITB Clause 30.

3.3 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 36.1 (a)(iii) of the General Conditions of Contract.

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, government-owned entity (subject to ITB Sub-Clause 4.5) or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture or Consortium/Association. In the case of a Joint Venture or Consortium/Association:

(a) all parties to a Joint Venture or Consortium/Association shall be jointly and severally liable; and

(b) a Joint Venture or Consortium/Association shall nominate a Representative who shall have the authority to conduct all businesses for and on behalf of any and all the parties of the Joint Venture or Consortium/Association.
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during the bidding process and, in the event the **Joint Venture or Consortium/Association** is awarded the Contract, during contract execution.

4.2 A Bidder, and all parties constituting the Bidder, may have the nationality of any country, subject to the restrictions **specified in Section V, Eligible Countries**. A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered and operates in conformity with the provisions of the laws of that country.

4.3 A Bidder shall not have a conflict of interest. All bidders found to have conflict of interest shall be disqualified. Bidders may be considered to have a conflict of interest with one or more parties in this bidding process, if they:

   (a) are or have been associated in the past, with a firm or any of its affiliates which have been engaged by the Purchaser to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the goods to be purchased under these Bidding Documents; or

   (b) submit more than one bid in this bidding process, except for alternative offers permitted under ITB Clause 13. However, this does not limit the participation of subcontractors in more than one bid;

4.4 A Bidder that is under a declaration of ineligibility by the Bank in accordance with ITB Clause 3, at the date of contract award, shall be disqualified.

4.5 A firm that has been determined to be ineligible by the Bank in relation to the Bank Guidelines On Preventing and Combating Fraud and Corruption in Projects Financed by EDCF shall not be eligible to be awarded a contract.

4.6 Government-owned enterprises in the Borrower’s Country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not a dependent agency of the Purchaser.

4.7 Bidders shall provide such evidence of their continued eligibility satisfactory to the Purchaser, as the Purchaser shall reasonably request.

5. **Eligible Goods and Related Services**

5.1 All the Goods and Related Services to be supplied under the Contract and financed by the Bank may have their origin in any country in accordance with Section V, Eligible Countries.

5.2 For purposes of this Clause, the term “goods” includes commodities, raw material, machinery, equipment, and industrial plants; and “related services” includes services such as insurance, installation, training, and initial maintenance.
5.3 The term “origin” means the country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or, through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

**B. Contents of Bidding Documents**

6. **Sections of Bidding Documents**

6.1 The Bidding Documents consist of Parts 1, 2, and 3, which include all the Sections indicated below, and should be read in conjunction with any Addendum issued in accordance with ITB Clause 8.

**PART 1 Bidding Procedures**

- Section I. Instructions to Bidders (ITB)
- Section II. Bidding Data Sheet (BDS)
- Section III. Evaluation and Qualification Criteria
- Section IV. Bidding Forms
- Section V. Eligible Countries

**PART 2 Supply Requirements**

- Section VI. Schedule of Requirements

**PART 3 Contract**

- Section VII. General Conditions of Contract (GCC)
- Section VIII. Special Conditions of Contract (SCC)
- Section IX. Contract Forms

6.2 The Invitation for Bids issued by the Purchaser is not part of the Bidding Documents.

6.3 The Purchaser is not responsible for the completeness of the Bidding Documents and their addendum, if they were not obtained directly from the Purchaser.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Documents. Failure to furnish all information or documentation required by the Bidding Documents may result in the rejection of the bid.

7. **Clarification of Bidding Documents, Site visit, and Pre-Bid**

7.1 A prospective Bidder requiring any clarification of the Bidding Documents shall contact the Purchaser in writing at the Purchaser’s address specified in the BDS. The Purchaser will respond in writing to any request for clarification, provided that such request is received no later than twenty-one (21) days prior
Meeting to the deadline for submission of bids. The Purchaser shall forward copies of its response to all those who have acquired the Bidding Documents directly from it, including a description of the inquiry but without identifying its source. Should the Purchaser deem it necessary to amend the Bidding Documents as a result of a clarification, it shall do so following the procedure under ITB Clause 8 and ITB Sub-Clause 24.2.

7.2 The Bidder is advised to visit and examine the final destination (Project Site) and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract. The costs of visiting the Site shall be at the Bidder’s own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Purchaser to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Purchaser and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 The Bidder’s designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Purchaser not later than one week before the meeting.

7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Documents in accordance with ITB Sub-Clause 6.3. Any modification to the Bidding Documents that may become necessary as a result of the pre-bid meeting shall be made by the Purchaser exclusively through the issue of an Addendum pursuant to ITB Clause 8 and not through the minutes of the pre-bid meeting.

7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Documents

8.1 At any time prior to the deadline for submission of bids, the Purchaser may amend the Bidding Documents by issuing addendum.

8.2 Any addendum issued shall be part of the Bidding Documents and shall be communicated in writing to all who have obtained the Bidding Documents directly from the Purchaser.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Purchaser may, at its discretion, extend the deadline for the submission of
bids, pursuant to ITB Sub-Clause 24.2

C. Preparation of Bids

9. Cost of Bidding

The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Purchaser, shall be written in English. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into English, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

The Bid shall comprise two envelopes submitted simultaneously, one containing the Technical Proposal and the other the Price Proposal, enclosed together in an outer single envelope.

11.1 The Technical Proposal shall contain the following:

(a) Technical Proposal Submission Sheet;
(b) Bid Security, in accordance with ITB Clause 21;
(c) alternative Technical Proposal, if permissible, in accordance with ITB Clause 13;
(d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB Clause 22;
(e) documentary evidence in accordance with ITB Clause 16 establishing the Bidder’s eligibility to bid;
(f) documentary evidence in accordance with ITB Clause 17, that the Goods and Related Services to be supplied by the Bidder are of eligible origin;
(g) documentary evidence in accordance with ITB Clauses 18 and 30, that the Goods and Related Services conform to the Bidding Document;
(h) documentary evidence in accordance with ITB Clause 19 establishing the Bidder’s qualifications to perform the contract if its Bid is accepted; and
(i) any other document required in the BDS.

11.2 The Price Proposal shall contain the following:

(a) Price Proposal Submission Sheet and the applicable Price Schedules, in accordance with ITB Clauses 12, 14, and 15;
(b) alternative Price Proposal corresponding to the alternative Technical Proposal, if permissible, in accordance with ITB Clause 13; and
(c) any other document required in the BDS.
12. Bid Submission Form and Price Schedules

12.1 The Bidder shall submit the Technical Proposal and the Price Proposal using the appropriate Submission Sheets furnished in Section IV, Bidding Forms. These forms must be completed without any alterations to their format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

12.2 The Bidder shall submit, as part of the Price Proposal, the Price Schedules for Goods and Related Services, according to their origin as appropriate, using the forms furnished in Section IV, Bidding Forms.

13. Alternative Bids

13.1 Unless otherwise specified in the BDS, alternative bids shall not be considered.

14. Bid Prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Bid Submission Form and in the Price Schedules shall conform to the requirements specified below.

14.2 All lots and items must be listed and priced separately in the Price Schedules. If a Price Schedule shows items listed but not priced, their prices shall be assumed to be included in the prices of other items. Items not listed in the Price Schedule shall be assumed not to be included in the Bid, and provided that the Bid is substantially responsive, the corresponding adjustment shall be applied in accordance with ITB Sub-Clause 31.3.

14.3 The price to be quoted in the Bid Submission Form shall be the total price of the bid, excluding any discounts offered.

14.4 The Bidder shall quote any unconditional discounts and indicate the method for their application in the Bid Submission Form.

14.5 The terms EXW, CIP, and other similar terms shall be governed by the rules prescribed in the current edition of Incoterms, published by The International Chamber of Commerce, as specified in the BDS.

14.6 Prices shall be quoted as specified in each Price Schedule included in Section IV, Bidding Forms. The dis-aggregation of price components is required for the purpose of facilitating the comparison of bids by the Purchaser. This shall not in any way limit the Purchaser’s right to contract on any of the terms offered. Prices shall be entered in the following manner:

(a) For Goods manufactured in the Purchaser’s Country:

   (i) the price of the Goods quoted EXW (ex works, ex factory, ex warehouse, ex showroom, or off-the-shelf, as applicable), including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of the Goods;

   (ii) any Purchaser’s Country sales tax and other taxes which will be payable on the Goods if the contract
is awarded to the Bidder; and

(iii) the price for inland transportation, insurance, and other local services required to convey the Goods to their final destination (Project Site) specified in the BDS.

(b) For Goods manufactured outside the Purchaser’s Country, to be imported:

(i) the price of the Goods, quoted CIP named place of destination, in the Purchaser’s Country, or CIF named port of destination, as specified in the BDS;

(ii) the price for inland transportation, insurance, and other local services required to convey the Goods from the named place of destination to their final destination (Project Site) specified in the BDS;

(iii) in addition to the CIP prices specified in (b)(i) above, the price of the Goods to be imported may be quoted FCA (named place of destination) or CPT (named place of destination), if so specified in the BDS;

(c) For Goods manufactured outside the Purchaser’s Country, already imported:

[For previously imported Goods, the quoted price shall be distinguishable from the original import value of these Goods declared to customs and shall include any rebate or mark-up of the local agent or representative and all local costs except import duties and taxes, which have been and/or have to be paid by the Purchaser. For clarity the bidders are asked to quote the price including import duties, and additionally to provide the import duties and the price net of import duties which is the difference of those values.]

(i) the price of the Goods, including the original import value of the Goods; plus any mark-up (or rebate); plus any other related local cost, and custom duties and other import taxes already paid or to be paid on the Goods already imported.

(ii) the custom duties and other import taxes already paid (need to be supported with documentary evidence) or to be paid on the Goods already imported;

(iii) the price of the Goods obtained as the difference between (i) and (ii) above;

(iv) any Purchaser’s Country sales and other taxes which will be payable on the Goods if the contract is awarded to the Bidder; and

(v) the price for inland transportation, insurance, and
other local services required to convey the Goods from the named place of destination to their final destination (Project Site) specified in the BDS.

(d) for Related Services, other than inland transportation and other services required to convey the Goods to their final destination, whenever such Related Services are specified in the Schedule of Requirements:

(i) the price of each item comprising the Related Services (inclusive of any applicable taxes).

14.7 Prices quoted by the Bidder shall be fixed during the Bidder’s performance of the Contract and not subject to variation on any account, unless otherwise specified in the BDS. A Bid submitted with an adjustable price quotation/price schedule shall be treated as non responsive and shall be rejected, pursuant to ITB Clause 30. However, if in accordance with the BDS, prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract, a bid submitted with a fixed price quotation/price schedule shall not be rejected, but the price adjustment shall be treated as zero.

14.8 If so indicated in ITB Sub-Clause 1.1, bids are being invited for individual contracts (lots) or for any combination of contracts (packages). Unless otherwise indicated in the BDS, prices quoted shall correspond to 100% of the items specified for each lot and to 100% of the quantities specified for each item of a lot. Bidders wishing to offer any price reduction (discount) for the award of more than one Contract shall specify the applicable price reduction in accordance with ITB Sub-Clause 14.4 provided the bids for all lots are submitted and opened at the same time.

15. Currencies of Bid

15.1 The Bidder shall quote in the currency specified in the BDS.

16. Documents Establishing the Eligibility of the Bidder

16.1 To establish their eligibility in accordance with ITB Clause 4, Bidders shall:

(a) complete the Bid Submission Form, included in Section IV, Bidding Forms; and

(b) if the Bidder is an existing or intended Joint Venture or Consortium/Association in accordance with ITB Sub-Clause 4.1, submit a copy of the Joint Venture or Consortium/Association Agreement, or a letter of intent to enter into such an Agreement. The respective document shall be signed by all legally authorized signatories of all the parties to the existing or intended Joint Venture or Consortium/Association, as appropriate.

17. Documents Establishing the Eligibility of the Goods and Related Services

17.1 To establish the eligibility of the Goods and Related Services in accordance with ITB Clause 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms,
Related Services included in Section IV, Bidding Forms.

18. Documents Establishing the Conformity of the Goods and Related Services

18.1 To establish the conformity of the Goods and Related Services to the Bidding Documents, the Bidder shall furnish as part of its Bid the documentary evidence that the Goods conform to the technical specifications and standards specified in Section VI, Schedule of Requirements.

18.2 The documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Schedule of Requirements.

18.3 The Bidder shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period specified in the BDS following commencement of the use of the goods by the Purchaser.

18.4 Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser’s satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Schedule of Requirements.

19. Documents Establishing the Qualifications of the Bidder

19.1 The documentary evidence of the Bidder’s qualifications to perform the contract if its bid is accepted shall establish to the Purchaser’s satisfaction:

(a) that, if required in the BDS, a Bidder that does not manufacture or produce the Goods it offers to supply shall submit the Manufacturer’s Authorization using the form included in Section IV, Bidding Forms to demonstrate that it has been duly authorized by the manufacturer or producer of the Goods to supply these Goods in the Purchaser’s Country;

(b) that, if required in the BDS, in case of a Bidder not doing business within the Purchaser’s Country, the Bidder is or will be (if awarded the contract) represented by an Agent in the country equipped and able to carry out the Supplier’s maintenance, repair and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and

(c) that the Bidder meets each of the qualification criterion specified in Section III, Evaluation and Qualification
20. Period of Validity of Bids

20.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Purchaser. A bid valid for a shorter period shall be rejected by the Purchaser as non-responsive.

20.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Purchaser may request bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB Clause 21, it shall also be extended for a corresponding period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its bid, except as provided in ITB Sub-Clause 20.3.

20.3 In the case of fixed price contracts, if the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the Contract price shall be adjusted as specified in the request for extension. Bid evaluation shall be based on the Bid Price without taking into consideration the above correction.

21. Bid Security

21.1 The Bidder shall furnish as part of its bid, a Bid Security or a Bid-Securing Declaration, if required, as specified in the BDS.

21.2 The amount and currency of the Bid Security shall be as specified in the BDS and the Bid Security shall:

(a) at the bidder’s option, be in the form of either a letter of credit, or a bank guarantee from a banking institution, or a bond issued by a surety;

(b) be issued by a reputable institution selected by the bidder and located in any eligible country as specified in ITB Clause 1 of Section V, Eligible Countries.

(c) be substantially in accordance with one of the forms of Bid Security included in Section IV, Bidding Forms, or other form approved by the Purchaser prior to bid submission;

(d) be payable promptly upon written demand by the Purchaser in case the conditions listed in ITB Sub-Clause 21.5 are invoked;

(e) be submitted in its original form; copies will not be accepted;

(f) remain valid for a period of 28 days beyond the validity period of the bids, as extended, if applicable, in accordance with ITB Sub-Clause 20.2;

21.3 If a Bid Security or a Bid-Securing Declaration is required in accordance with ITB Sub-Clause 21.1, any bid not accompanied by a substantially responsive Bid Security or Bid Securing...
Declaration in accordance with ITB Sub-Clause 21.1, shall be rejected by the Purchaser as non-responsive.

21.4 The Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder’s furnishing of the Performance Security pursuant to ITB Clause 44.

21.5 The Bid Security may be forfeited or the Bid Securing Declaration executed:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Bid Submission Form, except as provided in ITB Sub-Clause 20.2; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB Clause 42;
(ii) furnish a Performance Security in accordance with ITB Clause 43.

21.6 The Bid Security or Bid-Securing Declaration of a Joint Venture or Consortium/Association must be in the name of the Joint Venture or Consortium/Association that submits the bid. If the Joint Venture or Consortium/Association has not been legally constituted at the time of bidding, the Bid Security or Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent mentioned in Section IV “Bidding Forms,” Bidder Information Form Item 7.

21.7 If a bid security is not required in the BDS, and

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid Form, except as provided in ITB Sub-Clause 20.2, or

(b) if the successful Bidder fails to: sign the Contract in accordance with ITB Clause 42; or furnish a performance security in accordance with ITB Clause 43;

the Borrower may, if provided for in the BDS, declare the Bidder disqualified to be awarded a contract by the Purchaser for a period of time as stated in the BDS.

22. Format and Signing of Bid

22.1 The Bidder shall prepare one original of the Technical Proposal and one original of the Price Proposal as described in ITB Clause 11 and clearly mark each “ORIGINAL - TECHNICAL PROPOSAL” and “ORIGINAL - PRICE PROPOSAL”. In addition, the Bidder shall submit copies of the Technical Proposal and the Price Proposal, in the number specified in the BDS and clearly mark them “COPY NO…. - TECHNICAL PROPOSAL” and “COPY NO…. - PRICE PROPOSAL”. In the event of any discrepancy between the original and the copies, the original shall prevail.

22.2 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to
sign on behalf of the Bidder. All pages of the Bid, except for unamended printed literature, shall be signed or initialled by the person signing the Bid.

22.3 Any interlineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

23. Submission, Sealing and Marking of Bids

23.1 Bidders submitting bids by mail or by hand, shall enclose the original of the Technical Proposal, the original of the Price Proposal, and each copy of the Technical Proposal and each copy of the Price Proposal, including alternative bids, if permitted in accordance with ITB Clause 13, in separate sealed envelopes, duly marking the envelopes as “ORIGINAL - TECHNICAL PROPOSAL”, “ORIGINAL - PRICE PROPOSAL” and “COPY NO… - TECHNICAL PROPOSAL” and “COPY NO…. - PRICE PROPOSAL”, as appropriate. These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with ITB sub-Clauses 23.2 and 23.3.

23.2 The inner and outer envelopes shall:

(a) Bear the name and address of the Bidder;

(b) be addressed to the Purchaser in accordance with ITB Sub-Clause 24.1; and

(c) bear the specific identification of this bidding process indicated in ITB Sub-Clause 1.1 and any additional identification marks as specified in the BDS.

23.3 The outer envelopes and the inner envelopes containing the Technical Proposals shall bear a warning not to open before the time and date for the opening of Technical Proposals, in accordance with ITB Sub-Clause 27.1.

23.4 The inner envelopes containing the Price Proposals shall bear a warning not to open until advised by the Purchaser in accordance with ITB Sub-Clause 27.2.

23.5 If all envelopes are not sealed and marked as required, the Purchaser will assume no responsibility for the misplacement or premature opening of the bid.

23.6 Alternative Bids, if permissible in accordance with ITB Clause 13, shall be prepared, sealed, marked, and delivered in accordance with the provisions of ITB Clauses 22 and 23, with the inner envelopes marked in addition “ALTERNATIVE NO….” as appropriate.

24. Deadline for Submission of Bids

24.1 Bids must be received by the Purchaser at the address and no later than the date and time specified in the BDS.

24.2 The Purchaser may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Documents in
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accordance with ITB Clause 8, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

25. Late Bids

25.1 The Purchaser shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB Clause 24. Any bid received by the Purchaser after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

26. Withdrawal, Substitution, and Modification of Bids

26.1 A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice in accordance with ITB Clause 23, duly signed by an authorized representative, and shall include a copy of the authorization (the power of attorney) in accordance with ITB Sub-Clause 22.2, (except that no copies of the withdrawal notice are required). The corresponding substitution or modification of the bid must accompany the respective written notice. All notices must be:

(a) submitted in accordance with ITB Clauses 22 and 23 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” or “MODIFICATION;” and

(b) received by the Purchaser prior to the deadline prescribed for submission of bids, in accordance with ITB Clause 24.

26.2 Bids requested to be withdrawn in accordance with ITB Sub-Clause 26.1 shall be returned unopened to the Bidders.

26.3 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Bid Submission Form or any extension thereof.

27. Bid Opening

27.1 The Purchaser shall conduct the opening of Technical Proposals in the presence of Bidders’ representatives who choose to attend, at the address, date and time specified in the BDS.

27.2 The Price Proposals will remain unopened and will be held in custody of the Purchaser until the time of opening of the Price Proposals. The date, time, and location of the opening of Price Proposals will be advised in writing by the Purchaser.

27.3 First, envelopes marked “WITHDRAWAL” shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. If the withdrawal envelope does not contain a copy of the “power of attorney” confirming the signature as a person duly authorized to sign on behalf of the Bidder, the corresponding bid will be opened. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening.

27.4 Next, outer envelopes marked “SUBSTITUTION” shall be opened.
The inner envelopes containing the Substitution Technical Proposal and/or Substitution Price Proposal shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Proposal, if any, shall be opened, read out, and recorded. Substitution Price Proposals will remain unopened in accordance with ITB Sub-Clause 27.2. No envelope shall be substituted unless the corresponding Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

27.5 Next, outer envelopes marked “MODIFICATION” shall be opened. No Technical Proposal and/or Price Proposal shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Proposals. Only the Technical Proposals, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Proposals, both Original as well as Modification, will remain unopened in accordance with ITB Sub-Clause 27.2.

27.6 All other envelopes holding the Technical Proposals shall be opened one at a time, and the following read out and recorded:

(a) the name of the Bidder;
(b) whether there is a modification or substitution;
(c) the presence of a Bid Security, if required; and
(d) any other details as the Purchaser may consider appropriate.

Only Technical Proposals and alternative Technical Proposals read out and recorded at bid opening shall be considered for evaluation. No Bid shall be rejected at the opening of Technical Proposals except for late bids, in accordance with ITB Sub-Clause 25.1.

27.7 The Purchaser shall prepare a record of the opening of Technical Proposals that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, modification, or alternative offer; and the presence or absence of a Bid Security, if one was required. The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder’s signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

27.8 At the end of the evaluation of the Technical Proposals, the Purchaser will invite bidders who have submitted substantially responsive Technical Proposals and who have been determined as being qualified for award to attend the opening of the Price Proposals. The date, time, and location of the opening of Price Proposals will be advised in writing by the Purchaser. Bidders shall be given reasonable notice of the opening of Price Proposals.

27.9 The Purchaser will notify Bidders in writing who have been rejected on the grounds of being substantially non-responsive to the
requirements of the Bidding Document and return their Price Proposals unopened.

27.10 The Purchaser shall conduct the opening of Price Proposals of all Bidders who submitted substantially responsive Technical Proposals, in the presence of Bidders’ representatives who choose to attend at the address, date and time specified by the Purchaser. The Bidder’s representatives who are present shall be requested to sign a register evidencing their attendance.

27.11 All envelopes containing Price Proposals shall be opened one at a time and the following read out and recorded:

(a) the name of the Bidder
(b) whether there is a modification or substitution;
(c) the Bid Prices, including any discounts and alternative offers; and
(d) any other details as the Purchaser may consider appropriate.

Only Price Proposals, discounts, and alternative offers read out and recorded during the opening of Price Proposals shall be considered for evaluation. No Bid shall be rejected at the opening of Price Proposals.

27.12 The Purchaser shall prepare a record of the opening of Price Proposals that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders’ representatives who are present shall be requested to sign the record. The omission of a Bidder’s signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

28. Confidentiality

28.1 Information relating to the examination, evaluation, comparison, and postqualification of bids, and recommendation of contract award, shall not be disclosed to bidders or any other persons not officially concerned with such process until publication of the Contract Award.

28.2 Any effort by a Bidder to influence the Purchaser in the examination, evaluation, comparison, and postqualification of the bids or contract award decisions may result in the rejection of its Bid.

28.3 Notwithstanding ITB Sub-Clause 28.2, from the time of bid opening to the time of Contract Award, if any Bidder wishes to contact the Purchaser on any matter related to the bidding process, it should do so in writing.

29. Clarification of Bids

29.1 To assist in the examination, evaluation, comparison and post-qualification of the bids, the Purchaser may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification
submitted by a Bidder in respect to its Bid and that is not in response to a request by the Purchaser shall not be considered. The Purchaser’s request for clarification and the response shall be in writing. No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Purchaser in the Evaluation of the bids, in accordance with ITB Clause 31.

30. Responsiveness of Technical Proposal

30.1 The Purchaser’s determination of the responsiveness of a Technical Proposal is to be based on the contents of the Technical Proposal itself.

30.2 A substantially responsive Technical Proposal is one that conforms to all the terms, conditions, and specifications of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) affects in any substantial way the scope, quality, or performance of the Goods and Related Services specified in the Contract; or

(b) limits in any substantial way, inconsistent with the Bidding Documents, the Purchaser’s rights or the Bidder’s obligations under the Contract; or

(c) if rectified would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

30.3 If a Technical Proposal is not substantially responsive to the Bidding Document, it shall be rejected by the Purchaser and may not subsequently be made responsive by the Bidder by correction of the material deviation, reservation, or omission.

31. Nonconformities, Errors, and Omissions

31.1 Provided that a Technical Proposal is substantially responsive, the Purchaser may waive any non-conformity or omission in the Bid that does not constitute a material deviation.

31.2 Provided that a Technical Proposal is substantially responsive, the Purchaser may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial, nonconformities or omissions in the Technical Proposal related to documentation requirements. Such omission shall not be related to any aspect of the Price Proposal of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

31.3 Provided that a Technical Proposal is substantially responsive, the Purchaser will rectify nonmaterial nonconformities or omissions. To this effect, the Bid Price shall be adjusted during evaluation of Price Proposals, for comparison purposes only, to reflect the price of the missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section III, Evaluation and Qualification Criteria.

31.4 Provided that the Technical Proposal is substantially responsive, the Purchaser will correct arithmetical errors during evaluation of Price
Proposals on the following basis:

(a) if there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected, unless in the opinion of the Purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the line item total as quoted shall govern and the unit price shall be corrected;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

31.5 If the Bidder that submitted the lowest evaluated Bid does not accept the correction of errors, its Bid shall be rejected.

32. Preliminary Examination of Bids

32.1 The Purchaser shall examine the Technical Proposal to confirm that all documents and technical documentation requested in ITB Sub-Clause 11.2 have been provided, and to determine the completeness of each document submitted.

32.2 The Purchaser shall confirm that the following documents and information have been provided in the Technical Proposal. If any of these documents or information is missing, the offer shall be rejected.

(a) Technical Proposal Submission Sheet in accordance with ITB Sub-Clause 12.1;

(b) written confirmation of authorization to commit the Bidder;

(c) Bid Security, if applicable; and

(d) Manufacturer’s Authorization, if applicable.

32.3 Likewise, following the opening of Price Proposals, the Purchaser shall examine the Price Proposals to confirm that all documents and financial documentation requested in ITB Sub-Clause 11.3 have been provided, and to determine the completeness of each document submitted.

32.4 The Purchaser shall confirm that the following documents and information have been provided in the Price Proposal. If any of these documents or information is missing, the offer shall be rejected.

(a) Price Proposal Submission Sheet in accordance with ITB Sub-Clause 12.1; and

(b) Price Schedules, in accordance with ITB Clauses 12, 14, and 15.
33. Examination of Terms and Conditions; Technical Evaluation

33.1 The Purchaser shall examine the Bid to confirm that all terms and conditions specified in the GCC and the SCC have been accepted by the Bidder without any material deviation or reservation.

33.2 The Purchaser shall evaluate the technical aspects of the Bid submitted in accordance with ITB Clause 18, to confirm that all requirements specified in Section VI, Schedule of Requirements of the Bidding Documents have been met without any material deviation or reservation.

33.3 If, after the examination of the terms and conditions and the technical evaluation, the Purchaser determines that the Bid is not substantially responsive in accordance with ITB Clause 30, it shall reject the Bid.

34. Conversion to Single Currency

34.1 For evaluation and comparison purposes, the Purchaser shall convert all bid prices expressed in amounts in various currencies into an amount in a single currency specified in the BDS, using the selling exchange rates established by the source and on the date specified in the BDS.

35. Evaluation of Bids

35.1 The Purchaser shall evaluate Price Proposals of each Bid for which the Technical Proposal has been determined to be substantially responsive.

35.2 To evaluate a Price Proposal, the Purchaser shall only use all the criteria and methodologies defined in ITB Clause 35 and in Section III, Evaluation and Qualification Criteria. No other criteria or methodology shall be permitted.

35.3 To evaluate a Price Proposal, the Purchaser shall consider the following:

(a) the Bid Price as quoted in accordance with clause 14;

(b) price adjustment for correction of arithmetic errors in accordance with ITB Sub-Clause 31.4;

(c) price adjustment due to discounts offered in accordance with ITB Sub-Clause 14.4;

(d) adjustments due to the application of the evaluation criteria specified in the BDS from amongst those set out in Section III, Evaluation and Qualification Criteria;

35.4 The Purchaser’s evaluation of a bid will exclude and not take into account:

(a) in the case of Goods and Related Services offered from within the Purchaser’s country, all sales tax and all other taxes, applicable in the Purchaser’s country and payable on the Goods if the Contract is awarded to the Bidder;

(b) in the case of Goods and Related Services offered from outside the Purchaser’s country, all customs duties, sales tax, and other taxes, applicable in the Purchaser’s country...
and payable on the Goods if the Contract is awarded to the Bidder; and

(c) any allowance for price adjustment during the period of performance of the Contract, if provided in the Bid.

35.5 The Purchaser’s evaluation of a bid may require the consideration of other factors, in addition to the Bid Price quoted in accordance with ITB Clause 14. These factors may be related to the characteristics, performance, and terms and conditions of purchase of the Goods and Related Services. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of bids, unless otherwise specified in Section III, Evaluation and Qualification Criteria. The factors, methodologies and criteria to be used shall be as specified in ITB Sub-Clause 35.3 (d).

35.6 If so specified in the BDS, these Bidding Documents shall allow Bidders to quote separate prices for one or more lots, and shall allow the Purchaser to award one or multiple lots to more than one Bidder. The methodology of evaluation to determine the lowest-evaluated lot combinations, including any discounts offered in the Bid Submission Sheet, is specified in Section III, Evaluation and Qualification Criteria.

36. Comparison of Bids

36.1 The Purchaser shall compare all substantially responsive bids to determine the lowest-evaluated bid, in accordance with ITB Clause 35.

37. Postqualification of the Bidder

37.1 The Purchaser shall determine to its satisfaction during the evaluation of Technical Proposals whether Bidders are qualified to perform the Contract satisfactorily.

37.2 The determination shall be based upon an examination of the documentary evidence of the Bidder’s qualifications submitted by the Bidder, pursuant to ITB Clause 19, to clarifications in accordance with ITB Clause 29 and the qualification criteria indicated in Section III, Evaluation and Qualification Criteria. Factors not included in Section III, Evaluation and Qualification Criteria shall not be used in the evaluation of the Bidder’s qualification.

37.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder’s Price Proposal. A negative determination shall result into the disqualification of the Bid, in which event the Purchaser shall return the unopened Price Proposal to the Bidder.

38. Purchaser’s Right to Accept Any Bid, and to Reject Any or All Bids

38.1 The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders.

F. Award of Contract
39. **Award Criteria**

39.1 The Purchaser shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Documents, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

39.2 A Bid shall be rejected if the qualification criteria as specified in Section III, Evaluation and Qualification Criteria are no longer met by the Bidder whose offer has been determined to be the lowest evaluated Bid. In this event the Purchaser shall proceed to the next lowest evaluated Bid to make a similar reassessment of that Bidder’s capabilities to perform satisfactorily.

40. **Purchaser’s Right to Vary Quantities at Time of Award**

40.1 At the time the Contract is awarded, the Purchaser reserves the right to increase or decrease the quantity of Goods and Related Services originally specified in Section VI, Schedule of Requirements, provided this does not exceed the percentages specified in the BDS, and without any change in the unit prices or other terms and conditions of the bid and the Bidding Documents.

41. **Notification of Award**

41.1 Prior to the expiration of the period of bid validity, the Purchaser shall notify the successful Bidder, in writing, that its Bid has been accepted. At the same time, the Purchaser shall also notify unsuccessful Bidders of the results of the bidding including the following information:

(a) name of each Bidder who submitted a Bid;

(b) bid prices as read out at bid opening;

(c) name and evaluated prices of each Bid that was evaluated;

(d) name of bidders whose bids were rejected and the reasons for their rejection; and

(e) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded.

41.2 Until a formal Contract is prepared and executed, the notification of award shall constitute a binding Contract.

41.3 After notification of the award, unsuccessful bidders may request in writing to the Purchaser for a debriefing seeking explanations on the grounds on which their bids were not selected. The Purchaser shall promptly respond in writing to any unsuccessful Bidder who, after notification of contract award, requests a debriefing.

42. **Signing of Contract**

42.1 Promptly after notification, the Purchaser shall send the successful Bidder the Agreement and the Special Conditions of Contract.

42.2 Within twenty-eight (28) days of receipt of the Agreement, the successful Bidder shall sign, date, and return it to the Purchaser.
42.3 Notwithstanding ITB Sub-Clause 42.2 above, in case signing of the Contract Agreement is prevented by any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, where such export restrictions arise from trade regulations from a country supplying those products/goods, systems or services, the Bidder shall not be bound by its bid, always provided, however, that the Bidder can demonstrate to the satisfaction of the Purchaser and of the Bank that signing of the Contract Agreement has not been prevented by any lack of diligence on the part of the Bidder in completing any formalities, including applying for permits, authorizations and licenses necessary for the export of the products/goods, systems or services under the terms of the Contract.

43. Performance Security

43.1 Within twenty-eight (28) days of the receipt of notification of award from the Purchaser, the successful Bidder, if required, shall furnish the Performance Security in accordance with the GCC, using for that purpose the Performance Security Form included in Section IX Contract forms, or another Form acceptable to the Purchaser.

43.2 Upon the successful Bidder’s furnishing of the signed Contract Form and performance security pursuant to ITB Sub-Clause 43.1, the Purchaser shall promptly notify the name of the winning Bidder to each unsuccessful Bidder and discharge the Bid Securities of the unsuccessful bidders pursuant to ITB Sub-Clause 21.4.

43.3 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security or execution of the Bid-Securing Declaration. In that event the Purchaser may award the Contract to the next lowest evaluated Bidder, whose offer is substantially responsive and is determined by the Purchaser to be qualified to perform the Contract satisfactorily.
Section II. Bid Data Sheet (BDS)

The following specific data for the Goods to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

<table>
<thead>
<tr>
<th>ITB Clause Reference</th>
<th>A. General</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 1.1</td>
<td>The Purchaser is the Government of the Philippines (GOP) through the Department of Transportation and Communications.</td>
</tr>
<tr>
<td>ITB 1.1</td>
<td>This is a single package supply contract.</td>
</tr>
<tr>
<td>ITB 2.1</td>
<td>The Borrower is the Government of the Republic of the Philippines (GOP) thru the Department of Finance (DOF).</td>
</tr>
<tr>
<td>ITB 2.1</td>
<td>The name of the Project is Procurement of Laguindingan Airport - Air Navigation System and Support Facilities Supply Project.</td>
</tr>
<tr>
<td>ITB 3</td>
<td>ITB 3 is retitled as “Fraud, Corruption and Unfair Competition”</td>
</tr>
<tr>
<td>ITB 3.1(a)</td>
<td>Add the following definition after Sub-Clause 3.1(a) (v): (vi) “unfair competition” means any action that may prevent any bidder from quoting or purchasing the products or equipment to be sourced from monopolistic manufacturer, which can finally lead to actual inequitable competition.</td>
</tr>
<tr>
<td>ITB 3.1(b), (c) and (d)</td>
<td>Insert the words “unfair competition” between the words “collusive” and “or”.</td>
</tr>
<tr>
<td>ITB 3.2</td>
<td>Address for the Bank: 38 Eunhaengno (16-1 Yeouido-dong), Yeongdeungpo-gu, Seoul, Korea 150-996 TEL: 82-2-3779-6611 FAX: 82-2-3779-6756 E-Mail: <a href="mailto:jy_kang@koreaexim.go.kr">jy_kang@koreaexim.go.kr</a> Attention:</td>
</tr>
<tr>
<td>ITB 4.6</td>
<td>This clause shall be deleted in accordance with the restrictions regarding nationality of Eligible Bidder specified in ITB Sub-Clause 4.2.</td>
</tr>
<tr>
<td>ITB 4</td>
<td>Add the following new Sub-clauses after Sub-clause 4.7:</td>
</tr>
</tbody>
</table>
Among the manufacturer of the equipment needed for this project, the monopolistic manufacturer should provide same price quotes under the same condition to all bidders who want to participate in this bid. If the monopolistic manufacturer provides different price quotes to bidders, the final evaluated price and the contract price will be the lowest one. For the sake of comparison, the monopolistic manufacturer is required to submit a duly notarized/authenticated copy of the most recent unit price of contract which has been concluded.

The Bidder may subcontract portions of the contract to an extent as may be approved by the Purchaser. However, subcontracting of any portion shall not relieve the Bidder from any liability or obligation that may arise from the contract for this Project.

Subcontractors must comply with the eligibility criteria and the documentary requirements specified in ITB Clause 11.2. In the event that any subcontractor is found by the Purchaser to be ineligible, the subcontracting of such portion of the contract shall be disallowed.

Subcontractors are also bound by the same nationality requirement that applies to the principal suppliers, except where Korean contents are not available.

For clarification purposes only, the Purchaser’s address is:

Attention: The Chairman
Bids and Awards Committee

Thru: BAC Secretariat

Address: Department of Transportation and Communications
Unit 153, 15th Floor, The Columbia Towers
Ortigas Avenue, Mandaluyong City, Philippines
Telephone: Tel. No.: +632-654-77-25

Email address: dotcbacsec@yahoo.com

C. Preparation of Bids

A Pre-Bid meeting will take place at the following date, time and place:

Date: 02 August 2012
Time: 9:00 a.m.
Place: DOTC Conference Room, Unit 167, 16th Floor, The Columbia Towers, Ortigas Avenue, Mandaluyong City, Philippines

A site visit conducted by the Purchaser will be organized.

ITB 11.2 is amended to read as follows:

11.2 The Technical Bid shall comprise the following:

(a) **Form 1** - Technical Proposal Submission Form
(b) **Form 2** - Bid Security in accordance with ITB 21 of BDS

(c) Documentary evidence in accordance with ITB 16 establishing the **Bidder’s eligibility to bid**:

(c.1) **Form 3** - Bidder’s Information Form (BIF)

**Attachments:**

(i) **Form 3a** - Registration Certificate of Firm in accordance with ITB 4.1 and 4.2;

(ii) **Form 3b** - Omnibus Sworn Statement (includes written authorization of the signatory of the Bid to represent/commit the Firm/Bidder or Joint Venture or Consortium/Association Bidder in accordance with ITB 22.2);

(iii) **Form 3c** - In case of Joint Venture or Consortium/Association:

Valid Joint Venture or Consortium/Association Agreement entered into by all partners in case the Joint Venture or Consortium/Association is already in existence. In the absence of said Agreement duly notarized and authenticated statements from all the potential joint venture or Consortium/Association partners stating that they will enter into and abide by the provisions of the said Agreement in the instance that the bid is successful, shall be included in the bid.

(iv) **Form 3d** - The Bidder or the particular Joint Venture or Consortium/Association Member who will be responsible for providing the installation works of any component of the Project shall individually submit notarized and authenticated certificate/license to perform the installation of said component issued by appropriate Korean Government Agency.

(c.2) **Form 4** – Joint Venture or Consortium/Association Member Information Form

Note: Each member of a Joint Venture or Consortium/Association must fill in this form and must submit the following requirements as attachment:

**Attachments:**

(i) **Form 4a** - Registration Certificate of Firm in accordance with ITB 4.1 and 4.2;

(ii) **Form 4b** - Authorization to Represent the Firm (Joint Venture or Consortium/Association Member);

(d) The Bidder shall submit documentary evidence in accordance with ITB Clauses 18 and 30 that the Goods to be procured/installed for this contract conform to the Bidding Documents.
(d.1) **Form 5** – The Bidder shall furnish a Certification that its proposed Goods to be supplied/installed conform to the technical specifications as specified in Section VI, Schedule of Requirements;

(d.2) **Attachment 1 to Form 5** - The Bidder shall submit technical literature, drawings or data consisting of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services required for this Project, demonstrating substantial responsiveness of the said Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Schedule of Requirements:

(d.3) **Attachment 2 to Form 5** - The Bidder or its manufacturers of the Goods shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period of ten (10) years following commencement of the use of the Goods by the Purchaser, and

(d.4) **Attachment 3 to Form 5** - Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser’s satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Schedule of Requirements.

(d.5) **Attachment 4 to Form 5** - Implementation Schedule. Refer to Section VI-Schedule of Requirements for reference.

(e) **Form 6** - Documentary evidence in accordance with ITB Clause 19 establishing the Bidder’s qualification to perform the contract if its Bid is accepted:

(e.1) **Form 6a** - That in case the Bidder does not manufacture or produce any of the Goods it offers to supply, the Bidder shall submit a duly notarized and authenticated Manufacturer’s Authorization using the form included in Section IV, Bidding Forms, to demonstrate that it has been authorized by the original equipment manufacturer or producer of the said Goods to supply these Goods in the Philippines for the Laguindingan Airport. Include Manufacturer’s Certification of the availability of spare parts for the proposed Goods within 10 years after Defects Liability Period;

(e.2) **Form 6b** - The Bidder shall submit duly notarized and authenticated Warranty Certificate in accordance with GCC Clause 29 of the Bidding Documents using the form included in Section IV, Bidding Forms;

(e.3) **Form 6c** - that, if awarded the Contract, the Bidder or its representative/Agent (if any) in the country shall be equipped and able to carry out the Supplier’s maintenance, repair and spare parts-stocking obligations within the period of ten (10) years as prescribed in the Conditions of Contract and/or Technical Specifications;
(e.4) The Bidder shall duly accomplish and submit the following forms and their supporting documents to determine the Bidder’s compliance to the qualification criteria (adequate experience, financial capacity and technical capability to undertake the Contract) as specified in Section III, Evaluation and Qualification Criteria:

(f) **Form 7 - Contractual Experience**

Statement of satisfactorily completed one (1) similar contract each as **main contractor** within the last 10 years for the installation of the following project components:

**Air Navigation System:**
- **Form 7a** – Instrument Landing System (CAT-I: ILS)
- **Form 7b** – Doppler VOR/DME
- **Form 7c** - ATC Communication System

**Aeronautical Ground Lighting and Control System**
- **Form 7d** – Aeronautical Ground Lighting System

Note:

(i) As an attachment to the above Forms, each Bidder or any member of a Joint Venture or Consortium/Association (in the case of Joint Venture or Consortium/Association Bidder) who shall directly undertake the installation of the above project component must fill in this form.

(ii) “**Main Contractor**” is defined as the entity that has undertaken similar projects as the main or sole contractor or as a partner or member of a joint venture or joint operation (i.e. the work was not undertaken as a subcontractor); Notarized and authenticated certification of satisfactory completion shall be required from previous employers/owners to substantiate all claims for “Main Contractor” status on previous projects.

(iii) The minimum amount of required installation work per project component shall also include the amounts of the works that were subcontracted by the Bidder to other specialty subcontractors which formed part of the main contract awarded to the Bidder.

(g) **Form 8 - Technical Experience**

Notarized and authenticated copy of Documentary evidence that the following air navigation system/airfield lighting system component being offered have been in operation satisfactorily for not less than the number of
years specified below from the date of advertisement issued by previous client/purchaser:

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Minimum Requirements (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Instrument Landing System (CAT-I: ILS) (Form 8.1)</td>
<td>1</td>
</tr>
<tr>
<td>(b) Doppler VOR/DME (DVOR) (Form 8.2)</td>
<td>2</td>
</tr>
<tr>
<td>(c) ATC Communication System (Form 8.3)</td>
<td>1</td>
</tr>
<tr>
<td>(d) Automated Weather Observation System (AWOS) (Form 8.4)</td>
<td>2</td>
</tr>
<tr>
<td>(e) Airfield Lighting System (Form 8.5)</td>
<td>2</td>
</tr>
</tbody>
</table>

(h) **Form 9 - Size of Operation**

Average Annual Turnover (Amount billed to Clients for each year for work in progress or completed) for the last three (3) years, converted to US Dollar using the Bangko Sentral ng Pilipinas rate of exchange at the end of the period reported.

Note: Each Bidder or each member of a Joint Venture or Consortium/Association must fill in this form.

(i) **Form 10 - Financial Capacity**

Note: Each Bidder or member of a Joint Venture or Consortium/Association must fill in this form.

**Attachment:**

- **Form 10a – Audited Financial Statement**

  The Bidder shall submit audited financial statements or its published audited accounts, for the last three (3) fiscal years, showing, among others, the prospective Bidder’s total and current assets and liabilities, balance sheets, related notes and income statements;

  Note: All such documents reflect the financial situation of the Bidder or partner to a Joint Venture or Consortium/Association, and not sister or parent companies.

- **Form 10b - Financial Resources**

  The Bidder shall submit a Notarized and authenticated Commitment Letter from a universal or commercial bank to extend to it a credit line in its favor and it shall be used exclusively to finance the Project, when and if the Contract is awarded to the Bidder. If issued by a
foreign bank, it shall be confirmed or authenticated by a universal or commercial bank in the Philippines.

Note: Each Bidder or each member of a Joint Venture or Consortium/Association must fill in this form.

(j) **Form 11 - Pending Litigation**

The Bidder or all members of a Joint Venture or Consortium/Association must fill in this form.

(k) **Other Technical Requirements**

The Bidder shall submit the following additional requirements:

(k.1) **Form 12 - Site Organization**

(k.2) **Form 13 - Proposed Personnel**

The Bidder should provide the names of suitably qualified personnel to meet the following specified requirements:

<table>
<thead>
<tr>
<th>No.</th>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Manager (Electronics, Electrical or Air Navigation Engineer)</td>
</tr>
<tr>
<td>2</td>
<td>Chief Air Navigation Engineer</td>
</tr>
<tr>
<td>3</td>
<td>Chief Aeronautical Ground Lighting Engineer</td>
</tr>
<tr>
<td>4</td>
<td>Electrical Engineer</td>
</tr>
</tbody>
</table>

The data on their experience should be supplied using the **Form 13a:** Management Personnel – Experience Details for each candidate.

(k.3) **Form 14 - Mobilization Schedule (Manpower Utilization Schedule)**

(k.4) **Form 15 - Method Statement (Narrative Methodology)**

(k.5) **Form 16 - List of Proposed Subcontractors, if any**

(l) **Form 17 - Monopolistic Manufacturers’ Most Recent Unit Price of Contract which has been concluded**

The Bidder must submit a duly notarized/authenticated copy of the Monopolistic Manufacturers’ most recent unit price of similar Contract which has been concluded in accordance with ITB Clause 4.8.

(m) **Form 18 - Anti-Corruption and Anti-Malpractice Declaration**

The Bidder must submit the original signed Form 18 to the Bank in accordance with Clause ITB 3.2 of the Instructions to Bidders and include the copy of it in the bid, as set forth in the said ITB Clause.
The Price Proposal shall contain the following:

(a) Price Proposal Form 1 - Price Proposal Submission Form

(b) Price Proposal Form 2 – Price Schedule Forms (with attached Preamble and Price Schedules, in accordance with ITB Clauses 12, 14, and 15. As an Annex to the Price Schedule, the Bidder shall submit the list of items, quantities and cost of spare parts, tools, major assemblies, and selected components as mentioned in the Technical Specifications, to be required during the initial operation period of 3 years.

(c) Price Proposal Form 3 - Breakdown of Lump Sum Bid Items

Alternative Bids shall not be considered.

Delete the word “lots” found on the first line of this Sub-clause.


Amend Sub-clause ITB 14.6 to read as follows:

Prices shall be quoted as specified in each Price Schedule included in Section IV, Bidding Forms. The disaggregation of price components is required for the purpose of facilitating the comparison of bids by the Purchaser. This shall not in any way limit the Purchaser’s right to contract on any of the terms offered. Prices shall be entered in the following manner:

**Grand Summary:**

**Price Schedule 1: Goods Manufactured Outside the Purchaser’s Country, to be Imported**

The Price of Goods (including spare parts as mentioned under the Technical Specifications) quoted CIP (Carriage and Insurance Paid to named place of destination - Laguindingan Airport Project Site) to include all the international and domestic transportation, insurance and local services. The import duties and taxes levied on the Goods to be delivered in the Philippines shall be quoted under Price Schedule 5.

**Price Schedule 2: Goods Manufactured Outside the Purchaser’s Country, already Imported (Not Applicable)**

**Schedule 3: Goods Offered in the Purchaser’s Country**

The price of the Goods (including spare parts) quoted EXW (ex works, ex factory, ex warehouse, ex showroom, or off-the-shelf, as applicable), inland transportation, insurances and other cost incidental to the delivery of the Goods to the final destination as well as all custom duties and sales and other taxes already paid or payable:

(i) on the components and raw material used in the manufacture or assembly of Goods quoted ex works or ex factory; or
Section II. Bid Data Sheet

(ii) on the previously imported Goods of foreign origin quoted ex warehouse, ex showroom, or off-the-shelf.

Any Purchaser country sales and other taxes which will be payable on the Goods if the contract is awarded shall be included under Price Schedule 5.

Schedule 4: Related Services/Installation

Installation and other Related Services shall be quoted separately and shall include rates and prices for all labor, Supplier’s/Contractor’s construction equipment, temporary works, materials, consumable and all matters and things of whatsoever nature, including flight testing commissioning, operations and maintenance services, the provision of operations and maintenance manuals, training (factory training and on the job training) and inspection/test expenses (factory inspection, factory/site acceptance test), etc. as necessary for the proper execution of the Installation and Related Services. The import duties and taxes levied on the Installation and related services to be carried out in the Philippines shall be quoted under Price Schedule 5.

Schedule 5: Taxes and Duty

Taxes and Duty consists of all duties and taxes (including Value Added Tax) levied on Goods and installation/related services to be carried out by the Supplier in the Philippines as provided under the Contract, prevailing prior to the date of submission of price proposal/price quotation. All Taxes and Duty levied on Goods and installation/related services in the Philippines provided by the Suppliers for the implementation of the Project shall be borne by the Borrower.

Note: The Supplier/Bidder shall be deemed to be familiar with the tax laws in the Philippines.

Schedule 6: Summary (of each Component)

Note:

As an Annex to your Price Schedule Form, the Supplier shall submit the list of items, quantities and of spare parts (current cost included), special tools, major assemblies and selected components as mentioned in the Technical Specifications, to be required during the initial 3-years operation period.

**ITB 14.7**

The prices quoted by the Bidder shall be fixed and not subject to variation on any account as well as not subject to price adjustment during the performance of the contract.

**ITB 14.8**

Note: The existing provision is not applicable since this is single supply contract package.

This Sub-clause is replaced with the following provision:

Price Schedule for each individual item which is stated in “Lot” shall be the full and complete compensation for all work related to the item, whether specifically stated, implied or otherwise inferred elsewhere in the Contract Documents.
particularly as indicated in the Technical Specification and Drawings. It is the liability of the Supplier to conduct full assessment of the Drawings and Specifications provided in order that there would not be a missing item in the future for all “Lot” items.

<table>
<thead>
<tr>
<th>ITB 15</th>
<th>Clause ITB 15 is retitled as “Currencies of Bid and Contract”</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 15.1</td>
<td><strong>A. Currencies of Bid</strong></td>
</tr>
<tr>
<td></td>
<td>The unit rates and prices shall be entered by the Bidder into the Bill of Quantities as follows, to faithfully reflect the Bidder's anticipated foreign and local cost component:</td>
</tr>
<tr>
<td></td>
<td>(a) All Foreign Cost Component financed by EDCF shall be quoted in <strong>US Dollars (USD)</strong>.</td>
</tr>
<tr>
<td></td>
<td>(b) Local Cost Component financed by the Government of the Philippines shall be quoted in <strong>Philippine Peso (PHP)</strong>.</td>
</tr>
<tr>
<td></td>
<td><strong>B. Currencies of Contract</strong></td>
</tr>
<tr>
<td></td>
<td>The contract price for the Foreign Cost Component shall be stated in <strong>Korean Won (KRW)</strong> converted by using the exchange rate applicable to the calculation of the EDCF Loan under the provisions of the Loan Agreement (PHL-13) while the contract price for Local Cost Component (LCC) financed by GOP shall be stated in <strong>Philippine Peso (PHP)</strong>.</td>
</tr>
<tr>
<td>ITB 18.3</td>
<td>Period of time the Goods are expected to be functioning (for the purpose of spare parts): ten (10) years.</td>
</tr>
<tr>
<td>ITB 19.1 (a)</td>
<td>Manufacturer’s authorization /Original Equipment Manufacturer (OEM) Certification is required in case the Bidder/ Joint Venture or Consortium/Association Member will not be the manufacturer of the equipment required for this contract. Include Manufacturer’s Certification of the availability of spare parts for the proposed Goods within 10 years after Defects Liability Period.</td>
</tr>
<tr>
<td>TB 19.1 (b)</td>
<td>After sales service is required. Revise this sub-clause to read as follow:</td>
</tr>
<tr>
<td></td>
<td>The winning Bidder or its representative/Agent (if any) in the country shall be equipped and able to carry out the Supplier’s maintenance, repair and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications.</td>
</tr>
<tr>
<td>ITB 20.1</td>
<td>The bid validity period shall be <strong>120 calendar days</strong> after the bid submission deadline.</td>
</tr>
<tr>
<td>ITB 21.1</td>
<td>Bid shall include a Bid Security (issued by bank) included in Section IV Bidding Forms.</td>
</tr>
<tr>
<td><strong>ITB 21.2</strong></td>
<td>A Bid Security issued by a Universal or Commercial Bank in favor of DOTC shall be required in the form of Bank Guarantee or Manager’s Check in the amount of at least 2% of the Estimated Cost of the Contract. If issued by a foreign bank, it shall be confirmed or authenticated by a Universal or Commercial Bank in the Philippines.</td>
</tr>
<tr>
<td><strong>ITB 21.7</strong></td>
<td>If the Bidder incurs any of the actions prescribed in subparagraphs (a) or (b) of this provision, the Borrower will declare the Bidder ineligible to be awarded contracts by the Purchaser for a period of 1 year.</td>
</tr>
<tr>
<td><strong>ITB 22.1</strong></td>
<td>In addition to the original of the bid, the number of copies is: <strong>five.</strong></td>
</tr>
</tbody>
</table>

### D. Submission and Opening of Bids

| **ITB 23.2 (c)** | The inner and outer envelopes shall bear the following additional identification marks:

- **Project Name:** Procurement of Laguindingan Airport- Air Navigation System and Support Facilities Supply Project

| **ITB 24.1** | For **bid submission purposes** only, the Purchaser’s address is:

- The Chairman,
  Bids and Awards Committee
  Thru: The BAC-Secretariat
  The Department of Transportation and Communications
  Unit 167, 16th Floor, The Columbia Tower, Ortigas Avenue
  Mandaluyong City, Philippines

  **The deadline for bid submission is:**
  **Date:** 27 August 2012
  **Time:** 10:00 a.m.

| **ITB 27.1** | The bid opening shall take place at:

- DOTC Conference Room
  Unit 167, 16th Floor, The Columbia Towers, Ortigas Avenue
  Mandaluyong City, Philippines

  **Date:** 27 August 2012
  **Time:** 10:00 a.m.

| **ITB 27.1** | Electronic bid submission is not permitted. |
### Clause 27.6 is modified to conform with R.A. 9184 bidding procedures:

The BAC shall open the first envelope, “Technical Proposals”, of Bidders in public as specified in the BDS to determine each Bidder’s compliance with the documents prescribed in ITB Sub-clause 11.2. For this purpose, the BAC shall check the submitted documents of each bidder against a checklist of required documents to ascertain if they are all present, using a non-discretionary “pass/fail” criterion. If a bidder submits the required document, it shall be rated “passed” for that particular requirement. In this regard, bids that fail to include any requirement or are incomplete or patently insufficient shall be considered as “failed” and be subject to outright disqualification of bid and immediately return to the Bidder concerned its second (Financial) envelope unopened, unless the concerned Bidder has opted to request for reconsideration as provided for in R.A. 9184. Otherwise, the BAC shall rate the said first bid envelope as “passed”.

Immediately after determining compliance with the requirements in the first envelope (Technical Proposal), the BAC shall forthwith open the second bid envelope of each remaining eligible bidder whose first bid envelope was rated “passed”. The second envelope (Financial Proposal) of each complying bidder shall be opened within the same day. In case one or more of the requirements in the second envelope of a particular bid is missing, incomplete or patently insufficient, and/or if the submitted total bid price exceeds the Estimated Cost of the Contract, the BAC shall rate the bid concerned as “failed”. Only bids that are determined to contain all the bid requirements for both components shall be rated “passed” and shall immediately be considered for evaluation and comparison.

A Bidder determined as “failed” has three (3) calendar days upon written notice or, if present at the time of bid opening, upon verbal notification, within which to file a request or motion for reconsideration with the BAC: Provided, however, that the motion for reconsideration shall not be granted if it is established that the finding of failure is due to the fault of the Bidder concerned: Provided, further, that the BAC shall decide on the request for reconsideration within seven (7) calendar days from receipt thereof. If a failed Bidder signifies his intent to file a motion for reconsideration, the BAC shall keep the bid envelopes of the said failed Bidder unopened and/or duly sealed until such time that the motion for reconsideration or protest has been resolved.

The BAC shall prepare the minutes of the proceedings of the bid opening that shall include, as a minimum: (a) names of Bidders, their bid price, bid security, findings of preliminary examination; and (b) attendance sheet. The BAC members shall sign the abstract of bids as read.

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<tr>
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| ITB 27.8 to ITB 27.12 | Delete Sub-clauses 27.8 to ITB 27.12 in its entirety. |

### E. Evaluation and Comparison of Bids

| ITB 34.1 | For Bid comparison purposes, the Purchaser will convert the foreign cost component which is in US Dollars to Philippine Pesos at the selling exchange rates officially prescribed for similar transactions as established by the Bangko Sentral ng Pilipinas on the date twenty eight (28) calendar days prior to the |
| **ITB 35.6** | Not Applicable. This is a single package contract. |
| **F. Award of Contract** |
| **ITB 40.1** | Not Applicable |
| **ITB 41.1** | Replace the existing provisions of ITB Clause 41.1 with the following provisions: |
| | Prior to the expiration of the period of Bid validity, the Purchaser shall notify the successful Bidder, in writing, that its Bid has been accepted, through a Notice of Award received personally or sent by registered mail or electronically, receipt of which must be confirmed in writing within two (2) days by the successful bidder (the bidder with the lowest evaluated bid and is substantially responsive to the bidding requirements) and submitted personally or sent by registered mail or electronically to the Purchaser. |
| | Notwithstanding the issuance of the Notice of Award, award of contract shall be subject to the following conditions which shall be submitted by the successful Bidder within fourteen (14) days of receipt of the notification of award from the Purchaser, unless otherwise stated below: |
| | (a) Valid Joint Venture or Consortium/Association Agreement, if applicable in fourteen (14) calendar days; |
| | (b) Credit line in accordance with Section III – Evaluation and Qualification Criteria, Item 4 of Postqualification Requirements. |
| | (c) Posting of the Performance Security in accordance with ITB Clause 43; and |
| | (d) Signing of the contract as provided in ITB Clause 42. |
| **ITB 42.2 and ITB 43.1** | Change “twenty eight (28) days” to “fourteen (14) days” |
Section III. Evaluation and Qualification Criteria

This Section complements the Instructions to Bidders. It contains the criteria that the Purchaser may use to evaluate a bid and determine whether a Bidder has the required qualifications. No other criteria shall be used.

Contents

1. Evaluation Criteria (ITB Sub-Clause 35.3 (d))

2. Postqualification Requirements (ITB Sub-Clause 37.2)
1. **Evaluation Criteria (ITB Sub-Clause 35.3 (d))**

1.1 **Scope**

1.1.1. **Local Handling and Inland Transportation**

Not Applicable since the cost for international and domestic transportation to convey the Goods to the Laguindingan Project Site is considered part of the CIP cost.

1.1.2. **Minor Omissions or Missing Items**

Pursuant to Sub-Clause 31.3 of the Instructions to Bidders, the cost of all quantifiable non-material nonconformities or omissions from the contractual and commercial conditions shall be evaluated. The Purchaser will make its own assessment of the cost of any nonmaterial nonconformities and omissions for the purpose of ensuring fair comparison of Bids.

The adjustment for missing items should be based on prices quoted in other bids. An average of prices quoted in other bids will be the best measure of the amount to be added to the bid price for missing items.

1.2 **Technical Criteria**

The cost of all quantifiable deviations or deficiencies from the technical requirements as specified in Section VI, Schedule of Requirements shall be evaluated. The Purchaser will make its own assessment of the cost of these deviations or deficiencies for the purpose of ensuring fair comparison of Bids.

Adjustment of bid prices for non-material deviations from the Technical Specifications is carried out by using the average price quoted for the non-conforming items in conforming bids.

If the total amount of adjustment due to deviation from the Technical Specifications, when added to other adjustments, exceed about 15 percent of the bid price, the bid as a whole should be considered unresponsive and rejected.

1.3 **Economic Criteria**

The Purchaser’s evaluation of a bid may take into account, in addition to the Bid Price quoted in accordance with ITB Sub-Clause 14.6, one or more of the following factors as specified in ITB Sub-Clause 35.3(d) using the following criteria and methodologies.

1.3.1 **Adjustment for Deviations in the Delivery and Completion Schedule**

Bidders are required to base their prices on the Delivery and Completion Schedule specified in Section VI, Schedule of Requirements. Deviations from the specified Delivery and Completion Schedule are not permitted.

1.3.2 The Goods covered by this bidding process are required to be delivered in accordance with, and completed within, the Delivery and Completion Schedule specified in Section VI, Schedule of Requirements. No credit will be given for earlier completion. Bids offering delivery schedules beyond the date specified in Section VI, Schedule of Requirements, shall be rejected.
1.3.3 Adjustment for Deviation in Payment Schedule

Deviations from the Terms of Payment as specified in Special Conditions of Contract, Sub-Clause 16.1, are not permitted.

1.3.4 Cost of major replacement components and mandatory spare parts and tools

The Bidder shall submit the list of items, quantities and cost of spare parts, tools, major assemblies, and selected components as mentioned in the Technical Specifications, to be required during the initial operation period of 3 years as an Annex to this Price Schedule Forms. The total cost of these items at the unit prices quoted in each Bid shall form part of Schedule 1.

2. Postqualification Requirements (ITB Sub-Clause 37.2)

To ensure that the lowest-evaluated Bidder has the necessary qualifications to successfully fulfill its obligations under the contract, the Purchaser specifies the following minimum qualification criteria in this section.

All these criteria shall be evaluated on a pass/fail basis only.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUALIFICATION CRITERIA</th>
<th>MINIMUM REQUIREMENT (U.S. Dollars Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Contractual Experience (1 similar contract each, satisfactorily completed as main contractor within the last 10 years for the installation of the following project component)</td>
<td></td>
</tr>
<tr>
<td>(a) Air Navigation System</td>
<td>• ILS/DME</td>
<td>USD 0.29M</td>
</tr>
<tr>
<td>(b) Aeronautical Ground Lighting and Control System</td>
<td>• Aeronautical Ground Lighting System</td>
<td>USD 0.88M</td>
</tr>
</tbody>
</table>

Note:

(a) Each Bidder or any member of a Joint Venture or Consortium/Association (in the case of Joint Venture or Consortium/Association Bidder) who shall undertake the above similar contract must satisfy the minimum requirement.

(b) “Main Contractor” is defined as the entity that has undertaken similar projects as the main or sole contractor or as a partner or member of a joint venture or joint operation (i.e. the work was not undertaken as a subcontractor); Notarized and authenticated certification of satisfactory completion will be required from previous employers/owners to substantiate all claims for “Main Contractor” status on previous projects.

(c) The minimum amount of required installation work per project component shall also include the amounts of the works that were subcontracted by the Bidder to other specialty subcontractors which formed part of the main contract awarded to the Bidder.
(2) **Technical Experience**

No. of years that the following similar Air Navigation System/Airfield Lighting System components being offered have been in satisfactory operation from the date of Bid advertisement

- **ILS/DME**
  - Not less than 1 year

- **DVOR/DME**
  - Not less than 2 years

- **ATC Communication System**
  - Not less than 1 year

- **AWOS**
  - Not less than 2 years

- **Aeronautical Ground Lighting System**
  - Not less than 2 years

Note: Attach duly notarized and authenticated documentary evidence issued by previous clients/purchasers.

(3) **Average Annual Turnover for the last 3 years**

Computation: 2 x V/T

Where V = Estimated Cost of the Contract

T = Contract Duration, in years

USD 22,556M

Note: The Bidder or collectively in the case of Joint Venture or Consortium/Association must satisfy the minimum requirement.

(4) **Financial Capacity for the last 3 years**

(total assets less total liabilities)

Note: The Bidder and all member of the Joint Venture or Consortium/Association must comply with this requirement.

Positive

(5) **Cash Flow Capacity**

(Amount of Credit Line Commitment)

Computation: 10% of Estimated Cost of the Contract

Note: The Bidder or collectively in the case of Joint Venture or Consortium/Association must satisfy the minimum requirement.

USD 1.41M

Note: In addition to the above requirement, the Lead Member shall meet not less than 50% of the qualifying criteria given under items (3) and (5) above.

(6) **LITIGATION HISTORY**

All pending claims, arbitration, or other litigation shall represent in total not more than fifty percent (50%) of the Bidder’s net worth.

The Bidder or all members of a Joint Venture or Consortium/Association must fill in the Pending Litigation Form.

(7) **OTHER DOCUMENTATION REQUIREMENTS**

The Bidder shall submit other documentation requirement as stipulated in ITB Clause 11.2 and shall also comply with the following additional criteria:

(a) The Bidder’s key personnel shall meet the following minimum experience requirements:
### Section III. Evaluation and Qualification Criteria

<table>
<thead>
<tr>
<th>No.</th>
<th>POSITION</th>
<th>TOTAL WORK EXPERIENCE (years)</th>
<th>EXPERIENCE IN AIRPORT PROJECTS (years)</th>
<th>EXPERIENCE IN SIMILAR POSITION ON AIRPORT PROJECTS (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Manager (Electronics, Electrical or Air Navigation Engineer)</td>
<td>15</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Chief Air Navigation Engineer</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Chief Aeronautical Ground Lighting Engineer</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Electrical Engineer</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

(b) Subcontractors to be hired by the Bidder must comply with the eligibility criteria and the documentary requirements specified in ITB Clause 11.2. In the event that any subcontractor is found by the Purchaser to be ineligible, the subcontracting of such portion of the Goods shall be disallowed.
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Form 1 - Technical Proposal Submission Form

[The Bidder shall fill in this Form in accordance with the instructions indicated No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: [insert date (as day, month and year) of Bid Submission]
To: __________________________________________

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda No.: [insert the number and issuing date of each Addenda];

(b) We offer to undertake the Contract in conformity with the Bidding Documents and in accordance with the Supply, Delivery, Installation, Testing and Commissioning Schedules specified in the Schedule of Requirements of the following Goods and Related Services [insert a brief description of the Goods and Related Services];

(c) Our bid shall be valid for the period of time specified in ITB Sub-Clause 20.1, from the date fixed for the bid submission deadline in accordance with ITB Sub-Clause 24.1, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) If our bid is accepted, we commit to obtain a performance security in accordance with ITB Clause 43 and GCC Clause 19 for the due performance of the Contract;

(e) We, including any subcontractors, manufacturers or suppliers for any part of the contract, have nationality from eligible countries, unless otherwise specified under Section V. Eligible Countries [insert the nationality of the Bidder, including that of all parties that comprise the Bidder, if the Bidder is a Joint Venture or Consortium/Association, and the nationality each subcontractor and supplier].

(f) We have no conflict of interest in accordance with ITB Sub-Clause 4.2;

(g) Our firm, its affiliates or subsidiaries—including any subcontractors or suppliers for any part of the contract—has not been declared ineligible by the Bank, under the Purchaser’s country laws or official regulations, in accordance with ITB Sub-Clause 4.3;

(h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Signed: [insert signature of person whose name and capacity are shown]

In the capacity of [insert legal capacity of person signing the Bid Submission Form]

Name: [insert complete name of person signing the Bid Submission Form]

Duly authorized to sign the bid for and on behalf of: [insert complete name of Bidder]

Dated on ____________ day of __________________, _______ [insert date of signing]
Form 2 - Bid Security (Bank Guarantee)

[The Bank shall fill in this Bank Guarantee Form in accordance with the instructions indicated.]

_____________________________________________
[Bank's Name, and Address of Issuing Branch or Office]

Beneficiary: ___________________ [Name and Address of Purchaser]

Date: ________________

BID GUARANTEE No.: ________________

We have been informed that [name of the Bidder] (hereinafter called "the Bidder") has submitted to you its bid dated (hereinafter called "the Bid") for the execution of [name of contract] under Invitation for Bids No. [IFB number] ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we [name of Bank] hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of [amount in figures] ([amount in words]) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid; or

(b) having been notified of the acceptance of its Bid by the Purchaser during the period of bid validity, (i) fails or refuses to execute the Contract Form, if required, or (ii) fails or refuses to furnish the performance security, in accordance with the Instructions to Bidders.

This guarantee will expire: (a) if the Bidder is the successful bidder, upon our receipt of copies of the contract signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; or (b) if the Bidder is not the successful bidder, upon the earlier of (i) our receipt of a copy of your notification to the Bidder of the name of the successful bidder; or (ii) twenty-eight (28) days after the expiration of the Bidder’s Bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.

_____________________________
[signature(s)]
Form 2 - Continued

ENDORSEMENT BY A UNIVERSAL OR COMMERCIAL BANK IN THE PHILIPPINES *

We (name of universal or commercial bank) ______________________________ (hereinafter called “the Endorser”) certify that “the Bank” is a solvent financial institution of good reputation. We hereby agree to stand as guarantor for “the Bank” and shall meet the contractual obligations of “the Bank” in the event “the Bank” fails to meet the requirements of the above stated Guarantee.

____________________________________________________________________
DATE                       SIGNATURE OF THE ENDORSER

____________________________________________________________________
SEAL ________________________________

____________________________________________________________________
DATE                       SIGNATURE OF THE WITNESS

____________________________________________________________________
NAME OF THE WITNESS ____________________________

____________________________________________________________________
ADDRESS ________________________________

Note: All italicized text is for use in preparing this form and shall be deleted from the final product

* Not required if a Philippine Universal or Commercial Bank issues the Bid Security.
Form 3 - Bidder Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: [insert date (as day, month and year) of Bid Submission]

Page ________ of ______ pages

1. Bidder’s Legal Name  [insert Bidder’s legal name]

2. In case of Joint Venture or Consortium/Association, legal name of each member: [insert legal name of each member in Joint Venture or Consortium/Association]

3. Bidder’s actual or intended Country of Registration: [insert actual or intended Country of Registration]

4. Bidder’s Year of Registration: [insert Bidder’s year of registration]

5. Bidder’s Legal Address in Country of Registration: [insert Bidder’s legal address in country of registration]

6. Bidder’s Authorized Representative Information
   
   Name: [insert Authorized Representative’s name]
   
   Address: [insert Authorized Representative’s Address]
   
   Telephone/Fax numbers: [insert Authorized Representative’s telephone/fax numbers]
   
   Email Address: [insert Authorized Representative’s email address]

7. Attached are copies of original documents of: [check the box(es) of the attached original documents]

   □ Form 3a - Registration Certificate of the firm named in 1, above, in accordance with ITB Sub-Clauses 4.1 and 4.2.

   □ Form 3b- Notarized and authenticated Omnibus Sworn Statement with Written Authorization of the Signatory of the Bid.

   □ Form 3c - In case of Joint Venture or Consortium/Association, letter of intent to form a Joint Venture or Consortium/Association Agreement, in accordance with ITB Sub-Clause 4.1.

   □ Form 3d - Notarized and Authenticated Certificate-License of the Bidder or Joint Venture or Consortium/Association Member to perform the installation of (a) Air Navigation System and (b) Aeronautical Ground Lighting System issued by appropriate Korean Government Agency.
Form 3a - Registration Certificate of Firm

(Attach Registration Certificate of firm named in 1, above, in accordance with ITS Sub-Clauses 4.1 and 4.2.)
Form 3b - Omnibus Sworn Statement

 AFFIDAVIT

I, [Name of Affiant], of legal age, [Civil Status], [Nationality], and residing at [Address of Affiant], after having been duly sworn in accordance with law, do hereby depose and state that:

1. Select one, delete the other:
   If a sole proprietorship: I am the sole proprietor of [Name of Bidder] with office address at [address of Bidder];
   
   If a partnership, corporation, cooperative, or a Joint Venture or Consortium/Association: I am the duly authorized and designated representative of [Name of Bidder] with office address at [address of Bidder];

2. Select one, delete the other:
   If a sole proprietorship: As the owner and sole proprietor of [Name of Bidder], I have full power and authority to do, execute and perform any and all acts necessary to represent it in the bidding for [Name of the Project] of the [Name of the Purchaser];
   
   If a partnership, corporation, cooperative, or joint venture or consortium/association: I am granted full power and authority to do, execute and perform any and all acts necessary and/or to represent the [Name of Bidder] in the bidding as shown in the attached [state title of attached document showing proof of authorization (e.g., duly notarized Secretary’s Certificate issued by the corporation or the members of the joint venture)];

3. [Name of Bidder] is not “blacklisted” or barred from bidding by the Government of the Philippines or any of its agencies, offices, corporations, or Local Government Units, foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the Government Procurement Policy Board;

4. Each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;

5. [Name of Bidder] is authorizing the Head of the Purchaser or its duly authorized representative(s) to verify all the documents submitted;

6. Select one, delete the rest:
   If a sole proprietorship: I am not related to the Head of the Purchaser, members of the Bids and Awards Committee for Infrastructure Projects, the Technical Working Group, and the BAC, Secretariat, the Project Director and Project Manager of the LADP Project.
FORM 3b- Continued

Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

If a partnership or cooperative: None of the officers and members of [Name of Bidder] is related to the Head of the Purchaser, members of the Bids and Awards Committee for Infrastructure Projects, the Technical Working Group, and the BAC Secretariat, the Project Director and Project Manager of the LADP-Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

If a corporation or joint venture or consortium/association: None of the officers, directors, and controlling stockholders of [Name of Bidder] is related to the Head of the Purchaser, members of the Bids and Awards Committee for Infrastructure Projects, the Technical Working Group, and the BAC Secretariat, the Project Director and Project Manager of the LADP-Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

7. [Name of Bidder] complies with existing labor laws and standards; and

8. [Name of Bidder] is aware of and has undertaken the following responsibilities as a Bidder:

a) Carefully examine all of the Bidding Documents;

b) Acknowledge all conditions, local or otherwise, affecting the implementation of the Contract;

c) Made an estimate of the facilities available and needed for the contract to be bid, if any; and

d) Inquire or secure Supplemental/Bid Bulletin(s) issued for the [Name of the Project].

IN WITNESS WHEREOF, I have hereunto set my hand this __ day of ___, 20__ at ______________, Philippines.

Bidder’s Representative/Authorized Signatory

[JURAT]

Note: If acknowledged or notarized abroad, it must be authenticated by the Philippine Embassy in the Supplier’s country of origin/domicile, or by its embassy/consulate in the Philippines.
Form 3c - Joint Venture or Consortium/Association Agreement

To: _________________________________ [name and address of the Purchaser]

The undersigned of this declaration of cooperation are by means of attached Powers of Attorney legally authorized to act with regard to _________________________________ [name of the Project] and on behalf of their organizations.

They hereby declare:

1. that they will legalize a Joint Venture or Consortium/Association Agreement in case that a Contract for the ___________ [name of the Project] is awarded to their group;

2. that they have nominated ___________________ [name of the lead member] as the Lead Member of the group for the purpose of this Bid;

3. that they authorized Mr./Ms. _____________ [name of the person who is authorized to act as the Representative on behalf of the Joint Venture or Consortium/Association] to act as the Bidder's Representative in the name and on behalf of their group.

4. that all members of the Joint Venture or Consortium/Association shall be liable jointly and severally for the execution of the Contract;

5. that this Joint Venture or Consortium/Association is constituted for the purpose of the execution of the ___________ [name of the Project] under this Contract;

6. that if the Purchaser accepts the Bid of this Joint Venture, it shall not be modified in its composition or constitution until the completion of Contract without the prior consent of the Purchaser;

7. that it is hereby expressly agreed and understood that if the hereby Joint Venture or Consortium/Association fails to be awarded the contract, then the Agreement shall therefore cease, terminate automatically become void and have no further effect or force whatsoever. In the event however that the Joint Venture or Consortium/Association is awarded the aforementioned contract, then this Agreement shall remain in full force and effect as of the date hereon until the final completion and acceptance of the Project by the Purchaser.

8. that each member's share of the Work, stated as percentage of the total contract amount, shall be as follows:
Form 3c - Continued

<table>
<thead>
<tr>
<th>Name of Member</th>
<th>Share of the Work (as percentage of the contract amount)</th>
<th>Equipment to be Manufactured/Supplied and/or Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lead Member</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Other Member</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Other Member</td>
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<tr>
<td>4. Other Member</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Other Member</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

Give names and positions of the proposed Joint Venture or Consortium/Association Representatives, as well as organization's names and addresses:

1. Name: |
   
   Signature: |
   
   Position: |
   
   Date: |
   
   Representative of: (Organization's Name)

2. Name: |
   
   Signature: |
   
   Position: |
   
   Date: |
   
   Representative of: (Organization's Name)

3. Name: |
   
   Signature: |
   
   Position: |
   
   Date: |
   
   Representative of: (Organization's Name)

4. Name: |
   
   Signature: |
   
   Position: |
   
   Date: |
   
   Representative of: (Organization's Name)
Form 3d - Certificate/License of the Bidder/Joint Venture or Consortium/Association Member

(Attach a corresponding duly Notarized and Authenticated Certificate/License of the Bidder or its Joint Venture or Consortium/Association Member who will be responsible for providing the installation works of the (a) Air Navigation System and (b) Aeronautical Ground Lighting System issued by appropriate Korean Government Agency)

Note: If acknowledged or notarized abroad, it must be authenticated by the Philippine Embassy in the Supplier’s country of origin/domicile, or by its embassy/consulate in the Philippines.
Form 4 - Joint Venture or Consortium/Association Member Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below].

Date: [insert date (as day, month and year) of Bid Submission]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bidder’s Legal Name:</td>
<td>[insert Bidder’s legal name]</td>
</tr>
<tr>
<td>2. Joint Venture or Consortium/Association’s Member legal name:</td>
<td>[insert Joint Venture or Consortium/Association’s Member legal name]</td>
</tr>
<tr>
<td>3. Joint Venture or Consortium/Association’s Member Country of Registration:</td>
<td>[insert Joint Venture or Consortium/Association’s Member country of registration]</td>
</tr>
<tr>
<td>4. Joint Venture or Consortium/Association’s Member Year of Registration:</td>
<td>[insert Joint Venture or Consortium/Association’s Member year of registration]</td>
</tr>
<tr>
<td>5. Joint Venture or Consortium/Association’s Member Legal Address in Country of Registration:</td>
<td>[insert Joint Venture or Consortium/Association’s Member legal address in country of registration]</td>
</tr>
<tr>
<td>6. Joint Venture or Consortium/Association’s Member Authorized Representative Information Name:</td>
<td>[insert name of Joint Venture or Consortium/Association’s Member authorized representative]</td>
</tr>
<tr>
<td></td>
<td>Address: [insert address of Joint Venture or Consortium/Association’s Member authorized representative]</td>
</tr>
<tr>
<td></td>
<td>Telephone/Fax numbers: [insert telephone/fax numbers of Joint Venture or Consortium/Association’s Member authorized representative]</td>
</tr>
<tr>
<td></td>
<td>Email Address: [insert email address of Joint Venture or Consortium/Association’s Member authorized representative]</td>
</tr>
<tr>
<td>7. Attached are copies of original documents of:</td>
<td>[check the box(es) of the attached original documents]</td>
</tr>
<tr>
<td></td>
<td>Form 4a - Registration Certificate of the firm named in 2, above, in accordance with ITB Sub-Clauses 4.1 and 4.2.</td>
</tr>
<tr>
<td></td>
<td>Form 4b - Authorization to represent the firm (Joint Venture or Consortium/Association Member) named above.</td>
</tr>
</tbody>
</table>
Form 4a - Registration Certificate of Firm

(Attach Registration Certificate of firm named in 1, above, in accordance with ITS Sub-Clauses 4.1 and 4.2.)
Form 4b – Authorization to Represent the Firm (Joint Venture or Consortium/Association Member)

(Attach Authorization to represent the firm (Joint Venture or Consortium/Association’s Member) named under Form 4.)
**Form 5 - Conformity of Equipment with Bidding Documents**

**Name of Bidder or Member of a Joint Venture or Consortium/Association**

We hereby confirm that the Goods and Installation/Related Services proposed in our bid for the contract comply in all respects to the bid technical specifications and hereby submit documents providing the following information:

(a) **Attachment 1 to Form 5** - Technical literature, drawings or data consisting of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the said equipment and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Schedule of Requirements;

(b) **Attachment 2 to Form 5** - A list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period of ten (10) years following commencement of the use of the Goods by the Purchaser.

(c) **Attachment 3 to Form 5** - Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser’s satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Schedule of Requirements.

(d) **Attachment 4 to Form 5** - Implementation Schedule (Refer to Section VI- Schedule of Requirements for reference).

**Name and Signature (Authorized Representative)**

Date: ________________________________
Form 6 - Bidder’s Qualification Capabilities

Name of Bidder or Member of a Joint Venture or Consortium/Association

In accordance with Instructions to Bidders Clause, Bidders shall attach the following documentary evidence of their qualifications to perform the Contract if their bid is accepted:

a. **Form 6a** - In the case that the Bidder that is not the manufacturer of the Goods or producer of the proposed Goods required for this Contract, a letter from the original equipment manufacturer shall be attached to confirm that authorization has been given for the bidder to supply, deliver and install the said Goods for the proposed contract to or in the Philippines. (See attached Form6a - Manufacturer’s Authorization).

b. **Form 6b** - The Bidder shall submit duly notarized and authenticated Bidder’s Warranty Certificate in compliance with GCC Clause 29 of the Bidding Documents. (See attached Form 6b –Bidder’s Warranty Certificate).

c. **Form 6c** - The Bidder shall submit its duly notarized and authenticated Certificate that if awarded the Contract, the Bidder or its representative/Agent (if any) in the country shall be equipped and able to carry out the maintenance, repair and spare parts-stocking obligations within the period of ten (10) years as prescribed in the Conditions of Contract and/or Technical Specifications; (see attached Form 6c)

Note: If acknowledged or notarized abroad, it must be authenticated by the Philippine Embassy in the Bidder’s country of origin/domicile, or by its embassy/consulate in the Philippines.

Name and Signature (Authorized Representative)

Date: ___________________________
Form 6a - Manufacturer’s Authorization

Note: Include Notarized and authenticated Manufacturer’s Certification of the availability of spare parts for the proposed Goods within 10 years after Defects Liability Period;

[The Bidder shall require the Original Equipment Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Bidder shall include it in its bid, if so indicated in the BDS.]

Date: [insert date (as day, month and year) of Bid Submission]

To: [insert complete name of Purchaser]

WHEREAS

We [insert complete name of Manufacturer], who are official manufacturers of [insert type of goods manufactured], having factories at [insert full address of Manufacturer’s factories], do hereby authorize [insert complete name of Bidder] to submit a bid the purpose of which is to provide the following Goods, manufactured by us [insert name and or brief description of the Goods], and to subsequently negotiate and sign the Contract.

We hereby extend our full warranty and guarantee on the following, with respect to the aforementioned Goods offered by our firm:

1. that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

2. that all the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the country of final destination.

3. That the warranty shall remain valid for thirty six (36) months after the Goods, or any portion thereof as the case may be, have been delivered to, installed, tested and accepted at the final destination.

Signed: [insert signature(s) of authorized representative(s) of the Manufacturer]

Name: [insert complete name(s) of authorized representative(s) of the Manufacturer]

Title: [insert title]

Duly authorized to sign this Authorization on behalf of: [insert complete name of Bidder]

Dated on ____________ day of __________________, _______ [insert date of signing]
Form 6b – Bidder’s Warranty Certificate

[The Bidder shall fill in this Form in accordance with the instructions indicated. This letter should be on the letterhead of the Bidder and should be signed by a person with the proper authority to sign documents that are binding on the Bidder. This Certificate shall be duly notarized and authenticated, if notarized outside the Philippines]

Date: [insert date (as day, month and year) of Submission]

To: [insert complete name of Purchaser]

WHEREAS

We [insert complete name of Bidder], being one of the Bidders for this Project component with official business address at [insert full business address] do hereby submit a Proposal, the purpose of which is for the supply, delivery, installation, testing and commissioning of the following Goods, [insert name and or brief description of the Goods].

In case our firm is awarded the Contract, we hereby extend our full warranty and guarantee on the following, with respect to the aforementioned scope of work which is being offered by our firm in reply to the Invitation to Bid:

1. that all the Goods to be supplied for this Project component are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials;

2. that all the Goods as well as installation works (including related services) shall be free from defects arising from any act or omission of the Bidder or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the Philippines;

3. That the warranty shall remain valid for thirty six (36) months after the Goods, or any portion thereof as the case may be, have been delivered to, installed, tested, commissioned and accepted at the final destination, the Laguindingan Airport Project Site;

4. Pursuant to GCC Clause 29.8, during the first six (6) months of Operation Period which is within the Defects Liability Period, the following are the key personnel who shall at least stay at Project Site to observe for any possible defects:

   (a) Chief Air Navigation Engineer
   (b) Chief Aeronautical Ground Lighting Engineer
   (c) Electrical Engineer

   We have understood that the payment for the above key personnel for the six (6) month stay (on full time basis) during operation period shall be incidental to other items of work, hence, will not be measured and paid separately.

Signed: [insert signature(s) of authorized representative(s) of the Bidder]

Name: [insert complete name(s) of authorized representative(s) of the Bidder]

Title: [insert title]
Form 6c - Bidder’s Certificate of Maintenance, Repair and Spare parts-stocking obligations within the period of ten (10) years

(The Bidder shall submit Notarized and Authenticated Certificate that the Bidder or its representative/Agent (if any) in the country shall be equipped and able to carry out the Bidder’s maintenance, repair and spare parts-stocking obligations within the period of ten (10) years as prescribed in the Conditions of Contract and/or Technical Specifications)
Form 7 - Contractual Experience

Name of Bidder

Bidders are required to pass the specified requirements applicable to this form, as set out in the Section II, Instructions to Bidders and Section III, Evaluation and Qualification Criteria.

On a separate page, using the attached format, the Bidder shall list a similar contract each, satisfactorily completed as main contractor within the last ten (10) years for the installation of the following project components:

(a) ILS/DME  
(b) DVOR/DME  
(c) ATC Communication System  
(d) Aeronautical Ground Lighting System

The value shall be based on the currencies of the contracts converted into US Dollars (USD) at the date of completion.

Refer to Section III, Evaluation and Qualification Criteria for the required minimum amount of Contract needed to pass this requirement.

As an attachment to Form 7a to Form 7d, the Bidder shall enclose duly notarized and authenticated documentary evidence for the similar work completed immediately after the Form inclusive for each completed contract. If acknowledged or notarized abroad, it must be authenticated by the Philippine Embassy in the Bidder’s country of origin/domicile, or by its embassy/consulate in the Philippines.

Use a separate sheet for each contract.
# Form 7a - Installation of ILS/DME

## Details of Contracts of Similar Nature and Complexity

**Name of Bidder or Member of a Joint Venture or Consortium/Association**

As an attachment to Form 7a, Bidder shall attach a copy of documentary evidence to confirm satisfactory completion of contract. Use a separate sheet for each contract.

<table>
<thead>
<tr>
<th>1. Number of contract</th>
<th>Type and Model of Goods Installed <em>(Attach List)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of contract</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
</tbody>
</table>

| 2. Name of Employer     |                                               |

| 3. Employer’s address   |                                               |

| 4. Nature of works and special features relevant to the contract | |

<table>
<thead>
<tr>
<th>5. Contract role [check one]</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Sole Contractor</td>
</tr>
<tr>
<td>☐ Member in a Joint Venture</td>
</tr>
<tr>
<td>☐ Consortium or Association</td>
</tr>
<tr>
<td>☐ Subcontractor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Value in specified currencies at completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Contract Amount of the Bidder or Joint Venture or Consortium/Association</td>
</tr>
<tr>
<td>Member’s installation works of said type of equipment: ____________________ (name of currency)</td>
</tr>
</tbody>
</table>

| 7. Equivalent value of installation works of ILS/DME in US Dollars *(State date of currency conversion at the end of completion)* |

| 8. Date of award | |

| 9. Date of completion | |

<table>
<thead>
<tr>
<th>10. Contract duration (years and months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ years   _____ months</td>
</tr>
</tbody>
</table>

Name and Signature (Authorized Representative)

Date: ________________________________
**Form 7b - Installation of DVOR/DME**

**Details of Contracts of Similar Nature and Complexity**

<table>
<thead>
<tr>
<th>Name of Bidder or Member of a Joint Venture or Consortium/Association’s Member</th>
</tr>
</thead>
</table>

As an attachment to Form 7b, Bidder shall attach a copy of documentary evidence to confirm satisfactory completion of contract. Use a separate sheet for each contract.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Number of contract</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Type and Model of Goods Installed (Attach List)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Name of contract</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>2.</td>
<td><strong>Name of Employer</strong></td>
</tr>
<tr>
<td>3.</td>
<td><strong>Employer’s address</strong></td>
</tr>
<tr>
<td>4.</td>
<td><strong>Nature of works and special features relevant to the contract</strong></td>
</tr>
</tbody>
</table>
| 5. | **Contract role [check one]**
|   | ☐ Sole Contractor ☐ Member in a Joint Venture Consortium or Association ☐ Subcontractor |
| 6. | **Value in specified currencies at completion**
|   | **Total Contract Amount of the Bidder or Joint Venture or Consortium/Association Member’s installation works of said type of equipment : ___________ (name of currency)** |
| 7. | **Equivalent value of installation works of DVOR/DME in US Dollars (State date of currency conversion at the end of completion)** |
| 8. | **Date of award** |
| 9. | **Date of completion** |
| 10. | **Contract duration (years and months)**
|     | _______ years _______ months |

Name and Signature (Authorized Representative)

Date: __________________________________________
Form 7c - Installation of ATC Communication System

Details of Contracts of Similar Nature and Complexity

<table>
<thead>
<tr>
<th>Name of Bidder or Member of a Joint Venture or Consortium/Association</th>
</tr>
</thead>
</table>

As an attachment to Form 7c, Bidder shall attach a copy of documentary evidence to confirm satisfactory completion of contract. Use a separate sheet for each contract.

<table>
<thead>
<tr>
<th>1.</th>
<th>Number of contract</th>
<th>Type and Model of Goods Installed (Attach List)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name of contract</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Country</td>
<td></td>
</tr>
</tbody>
</table>

| 2. | Name of Employer   |

| 3. | Employer's address |

| 4. | Nature of works and special features relevant to the contract |

<table>
<thead>
<tr>
<th>5.</th>
<th>Contract role [check one]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sole Contractor</td>
</tr>
<tr>
<td></td>
<td>Member in a Joint Venture</td>
</tr>
<tr>
<td></td>
<td>Consortium or Association</td>
</tr>
<tr>
<td></td>
<td>Subcontractor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.</th>
<th>Value in specified currencies at completion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Contract Amount of the Bidder or Joint Venture or Consortium/Association Member’s installation works of said type of equipment: _____________ (name of currency)</td>
</tr>
</tbody>
</table>

| 7. | Equivalent value of installation works of ATC Communication System in US Dollars |
|    | (State date of currency conversion at the end of completion) |

| 8. | Date of award |

| 9. | Date of completion |

| 10. | Contract duration (years and months) |
|     | _______ years  _______ months |

Name and Signature (Authorized Representative)

Date: ________________________________
Form 7d -Installation of Aeronautical Ground Lighting System

Details of Contracts of Similar Nature and Complexity

| Name of Bidder or Member of a Joint Venture or Consortium/Association |

As an attachment to Form 7d, Bidder shall attach a copy of documentary evidence to confirm satisfactory completion of contract. Use a separate sheet for each contract.

<table>
<thead>
<tr>
<th>1.</th>
<th>Number of contract</th>
<th>Type and Model of Goods Installed (Attach List)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Name of Employer</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Employer’s address</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Nature of works and special features relevant to the contract</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Contract role [check one]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Sole Contractor</td>
<td>☐ Member in a Joint Venture or Consortium or Association</td>
</tr>
<tr>
<td>6.</td>
<td>Value in specified currencies at completion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Contract Amount of the Bidder or Joint Venture or Consortium/Association Member’s installation works of said type of equipment: _____________ (name of currency)</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Equivalent value of installation works of AGLS in US Dollars (State date of currency conversion at the end of completion)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Date of award</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Date of completion</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Contract duration (years and months)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_______ years</td>
<td>_______ months</td>
</tr>
</tbody>
</table>

Name and Signature (Authorized Representative)

Date: ______________________________
Form 8 - Technical Experience

Name of Bidder or Member of a Joint Venture or Consortium/Association

Attach Notarized and authenticated copy of Documentary evidence for the following:

i. that the following Air Navigation System/airfield lighting system components being offered have been in operation satisfactorily for not less than the following years from the date of advertisement issued by previous client/purchaser:

(a) ILS/DME (Form 8.1) - 1 year
(b) DVOR/DME (Form 8.2) - 2 years
(c) ATC Communication System (Form 8.3) – 1 year
(d) AWOS (Form 8.4) – 2 years
(e) Airfield Lighting System (Form 8.5) – 2 years
Form 9 - Size of Operation (Average Annual Turnover)

*Each Bidder or member of a Joint Venture or Consortium/Association must fill in this form*

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Currency</th>
<th>Exchange Rate</th>
<th>USD Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average Annual Turnover

The information supplied should be the Annual Turnover of the Bidder or each member of a Joint Venture or Consortium/Association in terms of the amounts billed to clients for each year for work in progress or completed over the last three (3) years, converted to US Dollar using the Bangko Sentral ng Pilipinas rate of exchange at the end of the period reported.

Name and Signature (Authorized Representative)

Date: _________________________________
Form 10 - Financial Capability

Name of Bidder or Member of a Joint Venture or Consortium/Association

Bidders, including each member of a Joint Venture or Consortium/Association shall provide financial information to demonstrate that they meet the requirements stated in the Instructions to Bidders. Each bidder or member of a Joint Venture or Consortium/Association must fill in this form. If necessary, use separate sheets to provide complete banker information. A copy of the audited balance sheets and statement of profit and losses shall be attached and shall form part of Form 10a.

<table>
<thead>
<tr>
<th>Banker</th>
<th>Name of banker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address of banker</td>
</tr>
<tr>
<td></td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Contact name and title</td>
</tr>
<tr>
<td></td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Telex</td>
</tr>
</tbody>
</table>

Summarize actual assets and liabilities in U.S. dollar equivalent (at the rates of exchange current at the end of each year) for the previous three (3) years.

<table>
<thead>
<tr>
<th>Financial information in USD equivalent</th>
<th>Actual: for the immediately preceding year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total assets</td>
<td></td>
</tr>
<tr>
<td>2. Current assets</td>
<td></td>
</tr>
<tr>
<td>3. Total liabilities</td>
<td></td>
</tr>
<tr>
<td>4. Current liabilities</td>
<td></td>
</tr>
</tbody>
</table>

Note: The total liabilities should exclude shareholders’ equity that comprises of capital, reserves and retained earnings.
Form 10 - Continued

Specify proposed sources of financing to meet the cash flow demands of the Project, net of current commitments for other contracts.

<table>
<thead>
<tr>
<th>Source of financing</th>
<th>Amount (USD equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

Attach audited financial statements in US dollars equivalent for the last three (3) financial years (for the individual bidder or each member of a Joint Venture or Consortium/Association under Form 10a.

Firms owned by individuals, and partnerships, may submit their balance sheets in US dollars certified by a registered accountant, and supported by copies of tax returns, if audits are not required by the laws of their countries of origin.

Bidders shall submit a bank reference letter from a reputable commercial bank to the effect that such bank certifies the financial capability of the bidder to meet their financial obligation to perform the said contract and considers to issue a specific line of credit when and if the contract is awarded to the Bidders. (Refer to attached Form 10b - Bank’s Letter of Commitment to issue Credit Line).

Signature of Authorized Representative

Date: ____________________________

NOTE:

If Partnership or Joint Venture or Consortium/Association, each Partner or Member Firm of Joint Venture or Consortium/Association shall submit the above requirements.
Form 10a – Bidder’s Audited Financial Statements for the last 3 financial years

Attach Bidder’s audited financial statements or its published audited accounts, for the last three (3) financial years in US Dollar equivalent, showing, among others, the Bidder’s total and current assets and liabilities, balance sheets, related notes and income statements;

Note: All such documents reflect the financial situation of the Bidder, and not sister or parent companies.

NOTE:

If Partnership or Joint Venture or Consortium/Association, each Partner or Member Firm of Joint Venture or Consortium/Association shall submit the above requirements.
Form 10b - Credit Line Certificate

Date: __________________

To:  THE CHAIRMAN
Bids and Awards Committee
The Department of Transportation and Communications
16th Floor, The Columbia Tower, Ortigas Avenue
Mandaluyong City, Philippines

CONTRACT/PROJECT : ______________________________

COMPANY/FIRM : _______________________________

ADDRESS : _______________________________

________________________________

BANK/FINANCING INSTITUTION : _______________________________

ADDRESS : _______________________________

________________________________

AMOUNT : _______________________________

This is to certify that the above Bank/Financing Institution with business address indicated above, commits to provide the <Bidder>, if awarded the above-mentioned Contract, a credit line in the amount specified above which shall be exclusively used to finance the performance of the above-mentioned contract subject to our terms, conditions and requirements.

The credit line shall be available within fifteen (15) calendar days after receipt by the <Bidder> of the Notice of Award and such line of credit shall be maintained until the project is completed by the Contractor.

This Certification is being issued in favor of said <Bidder> in connection with the bidding requirement of ____(Name of the Purchaser)__ for the above-mentioned Contract. We are aware that any false statements issued by us make us liable for perjury.

Name and Signature of Authorized
Financing Institution Officer : _______________________
Official Designation : _______________________

Name and Signature of Authorized
Financing Institution Officer : _______________________
Official Designation : _______________________


Form 10b - Continued

Concurred By:

Name & Signature of <Bidder>

Authorized Representative : _______________________

Official Designation : _______________________

Note:

The amount committed should be machine validated.

ENDORSEMENT BY A UNIVERSAL OR COMMERCIAL BANK IN THE PHILIPPINES *

We (name of universal or commercial bank) ______________________________

(herinafter called “the Endorser”) certify that “the Bank” is a solvent financial institution of good reputation. We hereby agree to stand as guarantor for “the Bank” and shall meet the contractual obligations of “the Bank” in the event “the Bank” fails to meet the requirements of the above stated Guarantee.

_______________________________________________

DATE                       SIGNATURE OF THE ENDORSER

SEAL _________________________________

_______________________________________________

DATE                       SIGNATURE OF THE WITNESS

NAME OF THE WITNESS ____________________________

ADDRESS ________________________________

Note: All italicized text is for use in preparing this form and shall be deleted from the final product

* Not required if a Philippine Universal or Commercial Bank issues the Credit Line Certificate.
Form 11- Pending Litigation

The Bidder or all members of a Joint Venture or Consortium/Association must fill in this form.

<table>
<thead>
<tr>
<th>Pending Litigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pending litigation in accordance with Criteria on Litigation History of Section III (Evaluation and Qualification Criteria)</td>
</tr>
<tr>
<td>Pending litigation in accordance with Criteria on Litigation History of Section III (Evaluation and Qualification Criteria)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Matter in Dispute</th>
<th>Value of Pending Claim in USD Equivalent</th>
<th>Value of Pending Claim as a Percentage of Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Form 12- Site Organization

The Bidder is required to attach the following information:

Detailed organization chart of the proposed On-Site Management Team that covers the entire Project Organization and which must show the positions held by all key management personnel to be assigned to the Project (including all the key and other management personnel specified in Form for “Proposed Personnel” hereto attached, together with the name of each person and the name of the company directly employing them).

Attach Site Organization Chart
Form 13 - Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements stated in Section III (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

*As listed in Section III (Evaluation and Qualification Criteria).
Form 13a - Management Personnel– Experience Details

<table>
<thead>
<tr>
<th>Name of Bidder:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Position:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Candidate information</th>
<th>Name of candidate</th>
<th>Date of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional qualifications (Note: a copy of the professional diplomas, certification or license to practice profession, etc. of the proposed candidate must be attached immediately after each completed form)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proficiency in English Language (Oral &amp; Written Communication):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent ☐ Good ☐ Fair ☐ Poor ☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present employment</th>
<th>Name of Employer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address of Employer</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>Contact (Manager or Personnel Officer)</td>
</tr>
<tr>
<td>Fax</td>
<td>Email Address</td>
</tr>
<tr>
<td>Current Job Title</td>
<td>Years with present Employer</td>
</tr>
</tbody>
</table>

The Bidder is required to provide below a summary of the professional experience of the candidate over the last 20 years.

<table>
<thead>
<tr>
<th>Item</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Work Experience</td>
<td></td>
</tr>
<tr>
<td>Construction Site Experience</td>
<td></td>
</tr>
<tr>
<td>Experience in Similar Position at Airport</td>
<td></td>
</tr>
<tr>
<td>Location of Construction Site Experience</td>
<td></td>
</tr>
</tbody>
</table>
The Bidder is required to demonstrate the candidate’s professional experience over the last 20 years in reverse chronological order in sufficient detail to back up the above summary information and to indicate the particular technical and managerial experience relevant to the role proposed for the candidate on this Project.

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Company / Project / Location / Position / Relevant Technical and Management Experience / Value of Project in USD equivalent / Length of Assignment (Years and Months)</th>
</tr>
</thead>
</table>

By completing and signing this form, the Bidder warrants that the proposed candidate will be available for the Project. The signature of the candidate hereunder further indicates (i) that the candidate swears to the veracity of the statements made on this form concerning his/her experience and (ii) that the candidate is aware of this submission and agrees to be available for the Project in the event that the Bidder is awarded the Contract.

(Signed by the Candidate):  
(Signed by Authorized Representative of the Bidder):  
Date: ___________________________
## Form 14 - Mobilization Schedule (Manpower Utilization Schedule)

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>....</th>
<th>15</th>
</tr>
</thead>
</table>

| Bidder’s Name: | Name of Employer: | Contract Name: |

Submitted by:

Name of the Representative of the Bidder: _____________________________      Date: ________________
Position: _______________________________________________________
Name of the Bidder: ______________________________________________
Form 15 - Method Statement

State general approach in implementation of the contract in terms of use of equipment-intensive or labor-based methods, any special techniques, methods or procedures to ensure completion on time and quality of financing the project, etc.

Attach Method Statement
(Narrative Methodology)
Form 16 - List of Proposed Subcontractors/Manufacturers

The Bidder is required to insert below the names of proposed Subcontractors/Manufacturers for the Project and to indicate the specific work they will be required to undertake or Goods to be Manufactured:

<table>
<thead>
<tr>
<th>Name of Subcontractors/Manufacturers</th>
<th>Elements of Work to be Undertaken/Goods to be Manufactured</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Name and Signature (Authorized Representative)

Date: ____________________________
Form 17 - Monopolistic Manufacturers’ Most Recent Unit Price of Contract which has been Concluded

Name of Bidder

The Bidder is required to attach a duly notarized/authenticated copy of its Monopolistic Manufacturers’ Most Recent Unit Price of Contract which has been concluded.

Attach Copy of the Most Recent Unit Price of Similar Contract which has been concluded by the Monopolistic Manufacturers (Notarized/Authenticated)
Price Proposal Form 1 –
Price Proposal Submission Form

[The Bidder shall fill in this Form in accordance with the instructions indicated No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: [insert date (as day, month and year) of Bid Submission]

To: [insert complete name of Purchaser]

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda No.: [insert the number and issuing date of each Addenda];

(b) We offer to undertake the Supply of all the Goods and their Installation/Related Services under the Contract in conformity with the Bidding Documents and in accordance with the Implementation Schedules specified in the Schedule of Requirements the following scope of work [insert a brief description of the scope of work];

(c) The total price of our Bid is: [insert the total bid price in words and figures, indicating the various amounts and the respective currencies];

(d) The following commissions, gratuities, or fees have been paid or are to be paid with respect to the bidding process or execution of the Contract: [insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
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</table>

(If none has been paid or is to be paid, indicate “none.”)

(e) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(f) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Signed: [insert signature of person whose name and capacity are shown]

In the capacity of [insert legal capacity of person signing the Bid Submission Form]

Name: [insert complete name of person signing the Bid Submission Form]

Duly authorized to sign the bid for and on behalf of: [insert complete name of Bidder]

Dated on ____________ day of __________________, _______ [insert date of signing]
Price Proposal Form 2 – Price Schedule Forms  
(See Attached Preamble and Price Schedule)

As an Annex to this Price Schedule Forms, the Bidder shall submit the list of items, quantities and cost of spare parts, tools, major assemblies, and selected components as mentioned in the Technical Specifications, to be required during the initial operation period of 3 years.
Price Proposal Form 3 – Breakdown of Lump Sum Bid Items

Using the given Price Schedule format, each lump sum bid item on the Price Schedule, as set forth in the Bid must be broken down separately. The Bidder shall prepare and submit a breakdown estimate covering each lump sum item to the Engineer for evaluation.

It is also the responsibility of the Bidder to check on the plans and technical specifications the items corresponding to the breakdown of lump sum bid which the Bidder will submit under Price Proposal Form 3 (Breakdown of Lump Sum Bid Items). Discrepancy on the quantities provided on the Price Proposal Form 3 (Breakdown of Lump Sum Bid Items) and that of quantities referred/shown on the plans shall not, in any way, be a ground for variation in the future.

Note that payment made for each individual item of the Price Schedule which is stated in “Lot” shall be the full and complete compensation for all work related to the item, whether specifically stated, implied or otherwise inferred elsewhere in the Contract Documents particularly as indicated in the Technical Specification and Drawings. It is the liability of the Supplier to conduct full assessment of the Drawings and Specifications provided in order that there would not be a missing item in the future for all “Lot” items.
Form 18 - Anti-Corruption and Anti-Malpractice Declaration

To The Export-Import Bank of Korea (the “Bank”)

We hereby confirm the following with regard to participating in the Project stated above financed by the Economic Development Cooperation Fund (EDCF):

- 다음 -

1. We undertake to fully understand and comply with the "Act on Preventing Bribery of Foreign Public Officials in International Business Transactions," and neither we nor any other party acting on our behalf with regard to the Project has engaged or will engage in corrupt or fraudulent practices.

2. If the Bank determines that we have engaged in corrupt or fraudulent practices with regard to the Project, we will not raise any objection to the following actions taken by the Bank:

가. To reject the approval or no-objection with regard to our participation in the Project;

나. To declare that we are ineligible for not more than 3 years to be awarded a contract financed by the EDCF loans, and to disclose our ineligibility at the Bank’s official website;

다. To inform the law enforcement authority if any act of bribery has been verified.
Section IV. Bidding Forms

3. If our company is found to have and be responsible for defective design and construction, or any other violation that could result in disqualification under Article 7-6 of the Regulation on EDCF Operation and Management, we hereby agree not to raise any objection to the Bank’s declaration that we are ineligible for not more than 3 years to be awarded a contract financed by the EDCF loans.

We will not raise any objection to the Bank’s declaration that we are ineligible for not more than 3 years to be awarded a contract financed by the EDCF loans if we fall under the ‘Ineligibility Criteria on Malpractice’ (attached hereto) of the Article 7-6 of the ‘Regulation on EDCF Operation and Management,’ such as defective design and construction, with regard to the Project.

Year / Month / Date

Name of the Company

Name of the Company Representative

* Attached : Ineligibility Criteria on Malpractice under Article 7-6 of ‘Regulation on EDCF Operation and Management’
Section IV. Bidding Forms

Ineligibility Criteria on Malpractice
(Article 7-6 of Regulation on EDCF Operation and Management)

1. Where the borrower raises an issue in writing on the defect of goods and services provided by the company in question, and the Bank determines it is reasonable

2. Where the company in question falls under the Article 76 (1)-1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17 of the ‘Enforcement Decree of the Act on Contracts to Which the State Is a Party’

Reference: ‘Enforcement Decree of the Act on Contracts to Which the State Is a Party’ Article 76 (1)

1. A person who has, in the execution of contractual obligations, performed deficiently, crudely or unreasonably, or committed a malpractice;

2. A person who has concluded a subcontract, in violation of the provisions concerning the limitation of the subcontract (excluding the case of violating the liability for notification of the subcontract) under the Framework Act on the Construction Industry, the Electrical Construction Business Act, the Information and Communication Work Business Act, or other Acts and subordinate statutes, and a person who has concluded a subcontract without the approval of the government agency which has placed the order or has changed the conditions of the subcontract approved by the said government agency;

3. A person who has, in the contract of survey and design services or of cost accounting services, failed to appropriately calculate the amount of survey and design or cost accounting by intention or gross negligence;

4. A person who has, in a service contract for feasibility study under Article 2 of the Construction Technology Management Act, inflicted damage on the ordering agency by improperly carrying out feasibility studies such as demand forecast, etc. by either intention or gross negligence;
5. 계약의 이행에 있어서 안전대책을 소홀히 하여 공중에게 위해를 가한 자 또는 사업장에서 「산업안전보건법」에 의한 안전·보건조치를 소홀히 하여 근로자등에게 사망등 중대한 위해를 가한 자
A person who has inflicted an injury on the general public by neglecting safety measures while fulfilling any contract or a person who has inflicted a serious injury, such as death, on employees, etc. by neglecting safety and health measures at a work place under the Industrial Safety and Health Act;

6. 정당한 이유없이 계약을 체결 또는 이행(제 19 조에 따른 부대입찰에 관한 사항, 제 42 조 제 5 항에 따른 계약이행능력심사를 위하여 제출한 하도급관리계획, 외주근로자 근로조건 이행계획에 관한 사항과 제 72 조 및 제 72 조의 2에 따른 공동계약에 관한 사항의 이행을 포함한다)하지 아니한 자
A person who has, without any just cause, failed to conclude or perform a contract (including the performance of matters concerning an incidental tender under Article 19, matters concerning the subcontract management plan and the performance plan for outsourcing workers' working conditions submitted for the review of the contract performance capability under Article 42 (5) and matters concerning a joint contract under Articles 72 and 72-2);

7. 경쟁입찰에 있어서 입찰자간에 서로 상의하여 미리 입찰가격을 협정하였거나 특정인의 낙찰을 위하여 탐합한 자
A person who has agreed upon the tendered price in advance by having discussed it between bidders or has committed a collusional agreement for successful tender by a specific person in the competitive tender;

8. 입찰 또는 계약에 관한 서류(제 39 조의 규정에 의하여 지정정보처리장치에 의하여 입찰서를 제출하는 경우의 「전자서명법」 제 2 조 제 8 호의 규정에 의한 공인인증서를 포함한다)를 위조·변조하거나 부정하게 행사한 자 또는 허위서류를 제출한 자
A person who has forged or altered documents concerning tender or contract (including any written public certification provided for in subparagraph 8 of Article 2 of the Digital Signature Act in case where the documents for the tender are submitted in use of the designated information processing unit) or used them unjustly, or a person who has produced the false document;

9. 고의로 무효의 입찰을 한 자
A person who has executed an invalid tender by intent;

10. 입찰·낙찰 또는 계약의 체결·이행과 관련하여 관계공무원(법 제 29 조 제 1 항에 따른 국제계약분쟁조정위원회, 이 영 제 42 조 제 7 항에 따른 입찰공익적정성심사위원회, 제 43 조 제 8 항에 따른 제안서평가위원회, 제 94 조 제 1 항에 따른 계약심의위원회, 건설기술관리법에 의한 중앙건설기술심의위원회·특별건설기술심의위원회 및 설계자문위원회의 위원을 포함한다)에게 뇌물을 준 자
A person who has, in relation to a bid, successful bid, or conclusion of a contract and execution thereof, offered a bribe to the relevant public official (including members of the International Contract Dispute Conciliation Committee under Article 29 (1) of the Act, the Committee for Examining the Adequacy of Tender Prices under Article 42 (7) of this Decree, the Committee for Evaluating Written Proposals under Article 43 (8) of this Decree, the Contract Council under Article 94 (1) of this Decree, the Central Construction Technology Deliberation Committee, the Special Construction Technology Deliberation Committee, and the Design Advisory Committee under the Construction Technology Management Act);
11. A person who has failed to participate in the bidding (excluding any bidding for which a written bidding is submitted by means of the designated information processing unit provided for in the provisions of Article 39 (2)) three times or more during the corresponding fiscal year without justifiable reasons even after having submitted a written application for participation in the tender or a written consent to participation in the tender;

12. A person who has interfered with participation in the tender or hinders a successful bidder from concluding the contract and executing it;

13. A person who has interfered with the performance of duties in the course of supervision or inspection;

14. A person who has, without any justifiable ground, failed to submit the full or part of the documents which are required for an examination of capabilities to perform the contract pursuant to Article 42 (1) or a person who has abandoned the examination after submitting the required documents before a successful bidder is finalized;

14의 2. A person who has, without any justifiable ground, failed to submit the full or part of the documents which are required for an examination after he/she was chosen as a participant in the examination of the adequacy of bidding prices pursuant to Article 42 (4) or a person who has abandoned the examination after submitting the required documents before a successful bidder is determined;

15. Where a successful bidder is determined for the package deal tender under Article 87, a person who has failed to submit a written execution design within the time limit without any justifiable reasons after being selected as a person suitable for the execution design;

17. A person who has caused damage to the State in a tender or a successful bid or during the process of the conclusion or performance of the contract by deceit or other fraudulent means;
Section V. Eligible Countries

1. In accordance with the Loan Agreement No. PHL-13 dated 13 October 2011, a Bidder and all parties constituting the Bidder, shall have the nationality of Korea.

2. All the Goods to be Supplied and Installation/Related Services under the Contract and financed by the Bank shall be procured from the Eligible Source Countries indicated as follows:

   A. Foreign Currency Portion shall be procured from Korea except where Korean contents are not available.

   B. Local Currency Portion shall be procured from the Republic of the Philippines.

3. All the Goods and Related Services/Installation to be financed out of the proceeds of the Loan shall be procured from the Eligible Source Countries, provided that a part of goods and services which are neither available nor economical to purchase from the Eligible Source Countries may, with the prior consent of the Bank, be procured from the countries other than the Eligible Source Countries up to four percent (4%) of the amount of Loan.
PART 2 – Supply Requirements
# Section VI. Schedule of Requirements

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<thead>
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<th>Item</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15</td>
</tr>
<tr>
<td>Production of Equipment</td>
<td>FAT</td>
</tr>
<tr>
<td>Delivery of Equipment</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td></td>
</tr>
<tr>
<td>Flight Test</td>
<td>F/T F/T F/T</td>
</tr>
<tr>
<td>Commissioning</td>
<td>SAT</td>
</tr>
</tbody>
</table>

Note: FAT - Factory Acceptance Test, F/T - Flight Test, SAT - Site Acceptance Test
2. Technical Specifications

(See Separate Documents)
### 3. Drawings

For reference, attached are copies of the following Drawings identifying the works already undertaken by the existing Civil Work Contractor:

<table>
<thead>
<tr>
<th>As Attached to the Bidding Documents</th>
<th>Note: Based on Signed Drawings (See Separate Documents)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sheet No.</strong></td>
<td><strong>Sheet Contents</strong></td>
</tr>
<tr>
<td>E-002 Rev A</td>
<td>Aeronautical Ground Lighting Layout</td>
</tr>
<tr>
<td>E-005 Rev A</td>
<td>Single Line Diagram</td>
</tr>
<tr>
<td>E-006 Rev A</td>
<td>Electrical Main Equipment Arrangement</td>
</tr>
<tr>
<td>E-007 Rev A</td>
<td>Power House, Power Layout</td>
</tr>
<tr>
<td>E-008 Rev A</td>
<td>Power House Grounding Layout</td>
</tr>
<tr>
<td>E-0019 Rev A</td>
<td>Air Lighting System ALS Center Line Barrette Foundation</td>
</tr>
<tr>
<td>E-0024 Rev A</td>
<td>Air Lighting System Runway Edge Lights Installation Detail - Insert Type</td>
</tr>
<tr>
<td>E-0025 Rev A</td>
<td>Air Lighting System Runway Edge Lights &amp; Taxiway Edge Lights Installation Detail (Elevated Type)</td>
</tr>
<tr>
<td>E-0026 Rev A</td>
<td>Air Lighting System Runway Threshold Lights Foundation</td>
</tr>
</tbody>
</table>
4. **Inspections and Tests**

(Inspection and tests shall be in accordance with the provisions specified in the Technical Specifications)
PART 3 – Contract
VII. General Conditions of Contract

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Section VII. General Conditions of Contract

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned to them:

(a) “The Bank” means the Export-Import Bank of Korea.

(b) “Contract” means the Contract Agreement entered into between the Purchaser and the Supplier, together with the Contract Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein.

(c) “Contract Documents” means the documents listed in the Contract Agreement, including any amendments thereto.

(d) “Contract Price” means the price payable to the Supplier as specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

(e) “Day” means calendar day.

(f) “Completion” means the fulfillment of the Related Services by the Supplier in accordance with the terms and conditions set forth in the Contract.

(g) “GCC” means the General Conditions of Contract.

(h) “Goods” means all of the commodities, raw material, machinery and equipment, and/or other materials that the Supplier is required to supply to the Purchaser under the Contract.

(i) “Purchaser’s Country” is the country specified in the Special Conditions of Contract (SCC).

(j) “Purchaser” means the entity purchasing the Goods and Related Services, as specified in the SCC.

(k) “Related Services” means the services incidental to the supply of the goods, such as insurance, installation, training and initial maintenance and other such obligations of the Supplier under the Contract.

(l) “SCC” means the Special Conditions of Contract.

(m) “Subcontractor” means any natural person, private or government entity, or a combination of the above, to whom any part of the Goods to be supplied or execution of any part of the Related Services is subcontracted by the Supplier.

(n) “Supplier” means the natural person, private or government entity, or a combination of the above, whose bid to perform the Contract has been accepted by the Purchaser and is named as such in the Contract Agreement.

(o) “The Project Site,” where applicable, means the place named
in the SCC.

(p) “The Effective date of the Contract,” when all of the conditions specified in the SCC have been fulfilled.

2. Contract Documents

2.1 Subject to the order of precedence set forth in the Contract Agreement, all documents forming the Contract (and all parts thereof) are intended to be correlative, complementary, and mutually explanatory. The Contract Agreement shall be read as a whole.

3. Fraud and Corruption

3.1 If the Purchaser determines that the Supplier has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices, in competing for or in executing the Contract, then the Purchaser may, after giving 14 days notice to the Supplier, terminate the Supplier’s employment under the Contract and cancel the contract, and the provisions of GCC Clause 36 shall apply as if such expulsion had been made under GCC Sub-Clause 36.1.

(a) For the purposes of this Sub-Clause:

(i) “corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(ii) “fraudulent practice” is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) “collusive practice” is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

(iv) “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(v) “obstructive practice” is

---

6 “another party” refers to a public official acting in relation to the procurement process or contract execution. In this context, “public official” includes The Bank staff and employees of other organizations taking or reviewing procurement decisions.

7 a “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

8 “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

9 a “party” refers to a participant in the procurement process or contract execution.
(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(bb) acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under Clause 11 [Inspections and Audits by the Bank].

3.2 Should any employee of the Supplier be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the purchase of the Goods, then that employee shall be removed.

4. Interpretation

4.1 If the context so requires it, singular means plural and vice versa.

4.2 Incoterms

(a) Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms.

(b) The terms EXW, CIP, FCA, CFR and other similar terms, when used, shall be governed by the rules prescribed in the current edition of Incoterms specified in the SCC and published by the International Chamber of Commerce in Paris, France.

4.3 Entire Agreement

The Contract constitutes the entire agreement between the Purchaser and the Supplier and supersedes all communications, negotiations and agreements (whether written or oral) of the parties with respect thereto made prior to the date of Contract.

4.4 Amendment

No amendment or other variation of the Contract shall be valid unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party thereto.

4.5 Nonwaiver

(a) Subject to GCC Sub-Clause 4.5(b) below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.
(b) Any waiver of a party’s rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

4.6 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

5. Language

5.1 The Contract as well as all correspondence and documents relating to the Contract exchanged by the Supplier and the Purchaser, shall be written in English. Supporting documents and printed literature that are part of the Contract may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified, in which case, for purposes of interpretation of the Contract, this translation shall govern.

5.2 The Supplier shall bear all costs of translation to the governing language and all risks of the accuracy of such translation, for documents provided by the Supplier.

6. Joint Venture, Consortium or Association

6.1 If the Supplier is a joint venture, consortium, or association, all of the parties shall be jointly and severally liable to the Purchaser for the fulfillment of the provisions of the Contract and shall designate one party to act as a leader with authority to bind the joint venture, consortium, or association. The composition or the constitution of the joint venture, consortium, or association shall not be altered without the prior consent of the Purchaser.

7. Eligibility

7.1 The Supplier shall have the nationality of an eligible country. A Supplier shall be deemed to have the nationality of a country if it is a citizen or constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country.

7.2 All Goods and Related Services to be supplied under the Contract and financed by the Bank shall have their origin in Eligible Countries. For the purpose of this Clause, origin means the country where the goods have been grown, mined, cultivated, produced, manufactured, or processed; or through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

8. Notices

8.1 Any notice given by one party to the other pursuant to the Contract shall be in writing to the address specified in the SCC. The term “in writing” means communicated in written form with proof of receipt.

8.2 A notice shall be effective when delivered or on the notice’s effective date, whichever is later.

9. Governing Law

9.1 The Contract shall be governed by and interpreted in accordance with the laws of the Purchaser’s Country, unless otherwise specified
10. Settlement of Disputes

10.1 The Purchaser and the Supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

10.2 If, after twenty-eight (28) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the Purchaser or the Supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Any dispute or difference in respect of which a notice of intention to commence arbitration has been given in accordance with this Clause shall be finally settled by arbitration. Arbitration proceedings shall be conducted in accordance with the rules of procedure specified in the SCC.

10.3 Notwithstanding any reference to arbitration herein,

(a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and

(b) the Purchaser shall pay the Supplier any monies due the Supplier.

11. Inspections and Audit by the Bank

11.1 The Supplier shall permit the Bank and/or persons appointed by the Bank to inspect the Supplier’s offices and/or the accounts and records of the Supplier and its sub-contractors relating to the performance of the Contract, and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank. The Supplier’s attention is drawn to GCC Clause 3, which provides, inter alia, that acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under GCC Sub-Clause 11.1 constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility under the Procurement Guidelines).

12. Scope of Supply

12.1 The Goods and Related Services to be supplied shall be as specified in the Schedule of Requirements.

13. Delivery and Documents

13.1 Subject to GCC Sub-Clause 34.1, the Delivery of the Goods and Completion of the Related Services shall be in accordance with the Delivery and Completion Schedule specified in the Schedule of Requirements. The details of shipping and other documents to be furnished by the Supplier are specified in the SCC.

14. Supplier’s Responsibilities

14.1 The Supplier shall supply all the Goods and Related Services included in the Scope of Supply in accordance with GCC Clause 12, and the Delivery and Completion Schedule, as per GCC Clause 13.

15. Purchaser’s Responsibilities

15.1 Whenever the supply of Goods and Related Services requires that the Supplier obtain permits, approvals, and import and other licenses from local public authorities, the Purchaser shall, if so required by the Supplier, make its best effort to assist the Supplier in complying with such requirements in a timely and expeditious manner.
15.2 The Purchaser shall pay all costs involved in the performance of its responsibilities, in accordance with GCC Sub-Clause 15.1.

16. **Contract Price**

16.1 Prices charged by the Supplier for the Goods supplied and the Related Services performed under the Contract shall not vary from the prices quoted by the Supplier in its bid, with the exception of any price adjustments authorized in the SCC.

17. **Terms of Payment**

17.1 The Contract Price, including any Advance Payments, if applicable, shall be paid as specified in the SCC.

17.2 The Supplier’s request for payment shall be made to the Purchaser in writing, accompanied by invoices describing, as appropriate, the Goods delivered and Related Services performed, and by the documents submitted pursuant to GCC Clause 13 and upon fulfillment of all other obligations stipulated in the Contract.

17.3 Payments shall be made promptly by the Purchaser, but in no case later than sixty (60) days after submission of an invoice or request for payment by the Supplier, and after the Purchaser has accepted it.

17.4 The currencies in which payments shall be made to the Supplier under this Contract shall be specified in the SCC.

17.5 In the event that the Purchaser fails to pay the Supplier any payment by its due date or within the period set forth in the SCC, the Purchaser shall pay to the Supplier interest on the amount of such delayed payment at the rate shown in the SCC, for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award.

18. **Taxes and Duties**

18.1 The Supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the Purchaser’s Country.

18.2 If any other restrictions for taxes and duties, the restrictions shall be specified in the SCC.

19. **Performance Security**

19.1 If required as specified in the SCC, the Supplier shall, within twenty-eight (28) days of the notification of contract award, provide a performance security for the performance of the Contract in the amount specified in the SCC.

19.2 The proceeds of the Performance Security shall be payable to the Purchaser as compensation for any loss resulting from the Supplier’s failure to complete its obligations under the Contract.

19.3 As specified in the SCC, the Performance Security, if required, shall be denominated in the currency(ies) of the Contract, or in a freely convertible currency acceptable to the Purchaser; and shall be in one of the format stipulated by the Purchaser in the SCC, or in another format acceptable to the Purchaser.

19.4 The Performance Security shall be discharged by the Purchaser and returned to the Supplier not later than twenty-eight (28) days following the date of Completion of the Supplier’s performance obligations under the Contract, including any warranty obligations,
20. Copyright

20.1 The copyright in all drawings, documents, and other materials containing data and information furnished to the Purchaser by the Supplier herein shall remain vested in the Supplier, or, if they are furnished to the Purchaser directly or through the Supplier by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party unless specified otherwise in the SCC.

21. Confidential Information

21.1 The Purchaser and the Supplier shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Supplier may furnish to its Subcontractor such documents, data, and other information it receives from the Purchaser to the extent required for the Subcontractor to perform its work under the Contract, in which event the Supplier shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Supplier under GCC Clause 21.

21.2 The Purchaser shall not use such documents, data, and other information received from the Supplier for any purposes unrelated to the contract. Similarly, the Supplier shall not use such documents, data, and other information received from the Purchaser for any purpose other than the performance of the Contract.

21.3 The obligation of a party under GCC Sub-Clauses 21.1 and 21.2 above, however, shall not apply to information that:

(a) the Purchaser or Supplier need to share with the Bank or other institutions participating in the financing of the Contract;

(b) now or hereafter enters the public domain through no fault of that party;

(c) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party; or

(d) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.

21.4 The above provisions of GCC Clause 21 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Supply or any part thereof.

21.5 The provisions of GCC Clause 21 shall survive completion or termination, for whatever reason, of the Contract.

22. Subcontracting

22.1 The Supplier shall notify the Purchaser in writing of all subcontracts awarded under the Contract if not already specified in the bid. Such notification, in the original bid or later shall not relieve the Supplier from any of its obligations, duties, responsibilities, or liability under
the Contract.

22.2 Subcontracts shall comply with the provisions of GCC Clauses 3 and 7.

23. Specifications and Standards

(a) The Goods and Related Services supplied under this Contract shall conform to the technical specifications and standards mentioned in Section VI, Schedule of Requirements and, when no applicable standard is mentioned, the standard shall be equivalent or superior to the official standards whose application is appropriate to the Goods’ country of origin.

(b) The Supplier shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designed by or on behalf of the Purchaser, by giving a notice of such disclaimer to the Purchaser.

(c) Wherever references are made in the Contract to codes and standards in accordance with which it shall be executed, the edition or the revised version of such codes and standards shall be those specified in the Schedule of Requirements. During Contract execution, any changes in any such codes and standards shall be applied only after approval by the Purchaser and shall be treated in accordance with GCC Clause 34.

24. Packing and Documents

24.1 The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. During transit, the packing shall be sufficient to withstand, without limitation, rough handling and exposure to extreme temperatures, salt and precipitation, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the goods’ final destination and the absence of heavy handling facilities at all points in transit.

24.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, specified in the SCC, and in any other instructions ordered by the Purchaser.

25. Insurance

25.1 Unless otherwise specified in the SCC, the Goods supplied under the Contract shall be fully insured—in a freely convertible currency from an eligible country—against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery, in accordance with the applicable Incoterms or in the manner specified in the SCC.

26. Transportation

26.1 Unless otherwise specified in the SCC, responsibility for arranging transportation of the Goods shall be in accordance with the specified Incoterms.
27. Inspections and Tests

27.1 The Supplier shall at its own expense and at no cost to the Purchaser carry out all such tests and/or inspections of the Goods and Related Services as are specified in the SCC.

27.2 The inspections and tests may be conducted on the premises of the Supplier or its Subcontractor, at point of delivery, and/or at the Goods’ final destination, or in another place in the Purchaser’s Country as specified in the SCC. Subject to GCC Sub-Clause 27.3, if conducted on the premises of the Supplier or its Subcontractor, all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the Purchaser.

27.3 The Purchaser or its designated representative shall be entitled to attend the tests and/or inspections referred to in GCC Sub-Clause 27.2, provided that the Purchaser bear all of its own costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

27.4 Whenever the Supplier is ready to carry out any such test and inspection, it shall give a reasonable advance notice, including the place and time, to the Purchaser. The Supplier shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.

27.5 The Purchaser may require the Supplier to carry out any test and/or inspection not required by the Contract but deemed necessary to verify that the characteristics and performance of the Goods comply with the technical specifications codes and standards under the Contract, provided that the Supplier’s reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of manufacturing and/or the Supplier’s performance of its other obligations under the Contract, due allowance will be made in respect of the Delivery Dates and Completion Dates and the other obligations so affected.

27.6 The Supplier shall provide the Purchaser with a report of the results of any such test and/or inspection.

27.7 The Purchaser may reject any Goods or any part thereof that fail to pass any test and/or inspection or do not conform to the specifications. The Supplier shall either rectify or replace such rejected Goods or parts thereof or make alterations necessary to meet the specifications at no cost to the Purchaser, and shall repeat the test and/or inspection, at no cost to the Purchaser, upon giving a notice pursuant to GCC Sub-Clause 27.4.

27.8 The Supplier agrees that neither the execution of a test and/or inspection of the Goods or any part thereof, nor the attendance by the Purchaser or its representative, nor the issue of any report pursuant to GCC Sub-Clause 27.6, shall release the Supplier from any warranties or other obligations under the Contract.

28. Liquidated Damages

28.1 Except as provided under GCC Clause 33, if the Supplier fails to deliver any or all of the Goods by the Date(s) of delivery or perform the Related Services within the period specified in the Contract, the
Section VII. General Conditions of Contract

29. Warranty

29.1 The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

29.2 Subject to GCC Sub-Clause 23.1(b), the Supplier further warrants that the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the country of final destination.

29.3 Unless otherwise specified in the SCC, the warranty shall remain valid for twelve (12) months after the Goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the SCC, or for eighteen (18) months after the date of shipment from the port or place of loading in the country of origin, whichever period concludes earlier.

29.4 The Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. The Purchaser shall afford all reasonable opportunity for the Supplier to inspect such defects.

29.5 Upon receipt of such notice, the Supplier shall, within the period specified in the SCC, expeditiously repair or replace the defective Goods or parts thereof, at no cost to the Purchaser.

29.6 If having been notified, the Supplier fails to remedy the defect within the period specified in the SCC, the Purchaser may proceed to take within a reasonable period such remedial action as may be necessary, at the Supplier’s risk and expense and without prejudice to any other rights which the Purchaser may have against the Supplier under the Contract.

30. Patent Indemnity

30.1 The Supplier shall, subject to the Purchaser’s compliance with GCC Sub-Clause 30.2, indemnify and hold harmless the Purchaser and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney’s fees and expenses, which the Purchaser may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of:

(a) the installation of the Goods by the Supplier or the use of the
Goods in the country where the Site is located; and

(b) the sale in any country of the products produced by the Goods.

Such indemnity shall not cover any use of the Goods or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, neither any infringement resulting from the use of the Goods or any part thereof, or any products produced thereby in association or combination with any other equipment, plant, or materials not supplied by the Supplier, pursuant to the Contract.

30.2 If any proceedings are brought or any claim is made against the Purchaser arising out of the matters referred to in GCC Sub-Clause 30.1, the Purchaser shall promptly give the Supplier a notice thereof, and the Supplier may at its own expense and in the Purchaser’s name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

30.3 If the Supplier fails to notify the Purchaser within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Purchaser shall be free to conduct the same on its own behalf.

30.4 The Purchaser shall, at the Supplier’s request, afford all available assistance to the Supplier in conducting such proceedings or claim, and shall be reimbursed by the Supplier for all reasonable expenses incurred in so doing.

30.5 The Purchaser shall indemnify and hold harmless the Supplier and its employees, officers, and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney’s fees and expenses, which the Supplier may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Purchaser.

31. Limitation of Liability

31.1 Except in cases of criminal negligence or willful misconduct,

(a) the Supplier shall not be liable to the Purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Supplier to pay liquidated damages to the Purchaser and

(b) the aggregate liability of the Supplier to the Purchaser, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the supplier to indemnify
Section VII. General Conditions of Contract

32. Change in Laws and Regulations

32.1 Unless otherwise specified in the Contract, if after the date of 28 days prior to date of Bid submission, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in the place of the Purchaser’s country where the Site is located (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Delivery Date and/or the Contract Price, then such Delivery Date and/or Contract Price shall be correspondingly increased or decreased, to the extent that the Supplier has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced cost shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with GCC Clause 16.

33. Force Majeure

33.1 The Supplier shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

33.2 For purposes of this Clause, “Force Majeure” means an event or situation beyond the control of the Supplier that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Supplier. Such events may include, but not be limited to, acts of the Purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.

33.3 If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

34. Change Orders and Contract Amendments

34.1 The Purchaser may at any time order the Supplier through notice in accordance GCC Clause 8, to make changes within the general scope of the Contract in any one or more of the following:

(a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Purchaser;

(b) the method of shipment or packing;

(c) the place of delivery; and

(d) the Related Services to be provided by the Supplier.

34.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier’s performance of any provisions
under the Contract, an equitable adjustment shall be made in the Contract Price or in the Delivery/Completion Schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this Clause must be asserted within twenty-eight (28) days from the date of the Supplier’s receipt of the Purchaser’s change order.

34.3 Prices to be charged by the Supplier for any Related Services that might be needed but which were not included in the Contract shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services.

34.4 Subject to the above, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

35. Extensions of Time

35.1 If at any time during performance of the Contract, the Supplier or its subcontractors should encounter conditions impeding timely delivery of the Goods or completion of Related Services pursuant to GCC Clause 13, the Supplier shall promptly notify the Purchaser in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Supplier’s notice, the Purchaser shall evaluate the situation and may at its discretion extend the Supplier’s time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract.

35.2 Except in case of Force Majeure, as provided under GCC Clause 33, a delay by the Supplier in the performance of its Delivery and Completion obligations shall render the Supplier liable to the imposition of liquidated damages pursuant to GCC Clause 27, unless an extension of time is agreed upon, pursuant to GCC Sub-Clause 35.1.

36. Termination

36.1 Termination for Default

(a) The Purchaser, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Supplier, may terminate the Contract in whole or in part:

(i) if the Supplier fails to deliver any or all of the Goods within the period specified in the Contract, or within any extension thereof granted by the Purchaser pursuant to GCC Clause 35;

(ii) if the Supplier fails to perform any other obligation under the Contract; or

(iii) if the Supplier, in the judgment of the Purchaser has engaged in fraud and corruption, as defined in GCC Clause 3, in competing for or in executing the Contract.

(b) In the event the Purchaser terminates the Contract in whole or in part, pursuant to GCC Clause 36.1(a), the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods or Related Services similar to those undelivered or not performed, and the Supplier shall be liable to the Purchaser for any additional costs for such similar
Goods or Related Services. However, the Supplier shall continue performance of the Contract to the extent not terminated.

36.2 Termination for Insolvency.

(a) The Purchaser may at any time terminate the Contract by giving notice to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to the Supplier, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the Purchaser.

36.3 Termination for Convenience.

(a) The Purchaser, by notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser’s convenience, the extent to which performance of the Supplier under the Contract is terminated, and the date upon which such termination becomes effective.

(b) The Goods that are complete and ready for shipment within twenty-eight (28) days after the Supplier’s receipt of notice of termination shall be accepted by the Purchaser at the Contract terms and prices. For the remaining Goods, the Purchaser may elect:

(i) to have any portion completed and delivered at the Contract terms and prices; and/or

(ii) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and Related Services and for materials and parts previously procured by the Supplier.

37. Assignment

37.1 Neither the Purchaser nor the Supplier shall assign, in whole or in part, their obligations under this Contract, except with prior written consent of the other party.

38. Export Restriction

38.1 Notwithstanding any obligation under the Contract to complete all export formalities, any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, which arise from trade regulations from a country supplying those products/goods, systems or services, and which substantially impede the Supplier from meeting its obligations under the Contract, shall release the Supplier from the obligation to provide deliveries or services, always provided, however, that the Supplier can demonstrate to the satisfaction of the Purchaser and of the Bank that it has completed all formalities in a timely manner, including applying for permits, authorizations and licenses necessary for the export of the products/goods, systems or services under the terms of
the Contract. Termination of the Contract on this basis shall be for the Purchaser’s convenience pursuant to GCC Sub-Clause 36.3.
Section VIII. Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement and / or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

| GCC 1.1(d) | “Contract Price” consists of EDCF loan proceeds (foreign cost component) and the GOP counterpart (local cost component). |
| GCC 1.1(i) | The Purchaser’s country is: The Republic of the Philippines |
| GCC 1.1(j) | The Purchaser or the Employer is: The Department of Transportation and Communications (DOTC). |
| GCC 1.1(n) | The term “Supplier” or the “Contractor” shall mean the same entity whose bid to perform the Contract has been accepted by the Purchaser and is named as such in the Contract Agreement. |
| GCC 1.1(o) | The Project Site(s)/Final Destination(s) is: The Laguindingan Airport located at Laguindingan, Misamis Oriental. |
| GCC 1.1(p) | The conditions listed below shall be fulfilled before the effective of Contract;  
1. The Contract Agreement has been duly signed between the Purchaser and the Supplier;  
2. Furnish the requirement Performance Security, and  
3. Other requirement as provided for in the General Conditions of Contract. |
| GCC 1.1(q) | “Supplier’s Construction Equipment” means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Supplier, but does not include Equipment, or other things intended to form or forming part of the Facilities. |
| GCC 1.1(r) | “Defect Liability Period” means the period of validity of the warranties given by the Supplier commencing at Completion of the Facilities during which the Supplier is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 29 (Warranty) hereof. |
| GCC 1.1(s) | “Engineer” is Yooshin Engineering Corporation of the Republic of Korea or any other competent person appointed by the Purchaser who shall supervise the management and execution of the Project. |
| GCC 1.1(t) | “Facilities” means the Equipment to be supplied and installed, as well as all the Installation Services to be carried out by the Supplier under the Contract. |
### GCC 1.1 (u)
“Related Services/Installation” means all those services ancillary to the supply of the Equipment for the Facilities, to be provided by the Supplier under the Contract; e.g., inspection, expediting, site preparation works (including the provision and use of Supplier’s Construction Equipment and the supply of all construction materials required), installation, testing, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc.

### GCC 3.1(a)
Add the following definition after Sub-Clause 3.1(a) (v):

(vi) “unfair competition” means any action that may prevent any bidder from quoting or purchasing the products or equipment to be sourced from monopolistic manufacturer, which can finally lead to actual inequitable competition.

### GCC 4.2 (a)
The meaning of the trade terms shall be as prescribed by Incoterms.

### GCC 4.2 (b)
The version edition of Incoterms shall be 2010.

### GCC 8.1
For notices, the Purchaser’s address shall be:

- **Attention:** The Chairman  
  Bids and Awards Committee  
- **Thru:** BAC Secretariat  
- **Address:** Department of Transportation and Communications  
  Unit 153, 15th Floor, The Columbia Towers  
  Ortigas Avenue, Mandaluyong City, Philippines  

- **Telephone:** Tel. No.: +632-654-77-25  
  Electronic mail address: dotcbacsec@yahoo.com

### GCC 9.1
The governing law shall be the law of: the Republic of the Philippines

### GCC 10.2
The formal mechanism for the resolution of disputes shall be:

In the case of a dispute between the Purchaser and the Supplier, the dispute shall be settled by arbitration under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators selected in accordance with said Rules.

### GCC 13.1
The Supplier shall attain completion of the Facilities within **Fifteen (15) Months** or within such extended time as the Contractor shall be entitled under GCC Clause 35 hereof, without prejudice to GCC Sub-Clause 28, the Supplier shall thereafter proceed with the Facilities in accordance with the time schedule specified in the corresponding Section VI (Schedule of Requirements).

Details of shipping and documents to be furnished by the Supplier shall be as follow:

For Goods supplied from abroad as per Incoterms CIP:

Upon shipment, the Supplier shall notify the Purchaser and the Insurance Company by telex or fax the full details of the shipment, including Contract...
number, description of Goods, quantity, the vessel, the bill of lading number and date, port of loading, date of shipment, port of discharge, etc. The Supplier shall send the following documents to the Purchaser, with a copy to the Insurance Company:

i. …copies of the Supplier’s invoice showing the description of the Goods, quantity, unit price, and total amount;

ii. original and….copies of the negotiable, clean, on-board bill of lading marked “freight prepaid” and….copies of non-negotiable bill of lading;

iii. ….copies of the packing list identifying contents of each package;

iv. insurance certificate;

v. Manufacturer’s or Supplier’s warranty certificate;

vi. inspection certificate, issued by the nominated inspection agency, and

vii. the Supplier’s factory inspection report; and

viii. certificate of origin.

The Purchaser shall receive the above documents at least \[insert the required time, such as one week, to handle the documents for obtaining, but not limited to, all necessary permits, approvals, or any other procedures in regard to customs clearance or taxation matter] before arrival of the Goods at the port or place of arrival and, if not received, the Supplier will be responsible for any consequent expenses.

The Supplier shall handle all imported Equipment and Supplier’s Construction Equipment at the point of import and shall handle formalities for customs clearance, subject to Purchaser’s obligation under GCC Sub-clause 15.1, provided that if applicable laws and regulations requires application or act to be made by or in the name of the Purchaser , the Purchaser shall take all necessary steps to comply with such laws or regulations.

For Goods from within the Purchaser’s country as per Incoterm EXW:

Upon delivery of the Goods to the transporter, the Supplier shall notify the Purchaser and send the following documents to the Purchaser:

(a) ….copies of the Supplier’s invoice showing the description of the Goods, quantity, unit price, and total amount;

(b) delivery note, railway receipt, or truck receipt;

(c) Manufacturer’s or Supplier’s warranty certificate;

(d) inspection certificate issued by the nominated inspection agency, and the Supplier’s factory inspection report; and

(e) certificate of origin.
The Purchaser, shall receive the above documents before the arrival of the Goods and, if not received, delay might occur in the processing of payment.

GCC 16.1

The prices charged for the Goods supplied and the related Services performed shall not be adjustable.

GCC 17.1

Terms of payment shall be set up in accordance with the scope of work for the Contract.

GCC 17.1—The method and conditions of payment to be made to the Supplier under this Contract shall be as follows:

Schedule No. 1 - Goods Manufactured Outside the Purchaser’s Country

In respect of equipment supplied from abroad, the following payments shall be made:

Ten percent (10%) of the total CIP amount as an advance payment against receipt of invoice and an irrevocable advance payment security for the equivalent amount made out in favor of the Purchaser.

Eighty percent (80%) of the total or pro rata CIP or amount upon Incoterm “CIP,” upon delivery to Site within sixty (60) days after receipt of invoice,

Five percent (5%) of the total or pro rata CIP or amount upon issue of the Completion Certificate, within sixty (60) days after receipt of invoice.

Five percent (5%) of the total or pro rata CIP or amount upon issue of the Operational Acceptance Certificate, within sixty (60) days after receipt of invoice.

Schedule No. 3 - Goods Offered in the Purchaser’s Country

In respect of equipment supplied from within the Purchaser’s country, the following payments shall be made:

Ten percent (10%) of the total amount as an advance payment against receipt of invoice, and an irrevocable advance payment security for the equivalent amount made out in favor of the Purchaser. The advance payment security may be reduced in proportion to the value of the equipment delivered to the site, as evidenced by shipping and delivery documents.

Eighty percent (80%) of the total or pro rata amount upon delivery to the site within sixty (60) days after receipt of invoice.

Five percent (5%) of the total or pro rata amount upon issue of the Completion Certificate, within sixty (60) days after receipt of invoice.

Five percent (5%) of the total or pro rata amount upon issue of the Acceptance Certificate, within sixty (60) days after receipt of invoice.
### Schedule No. 4 - Related Services/Installation

In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

Ten percent (10%) of the total installation and other services amount as an advance payment against receipt of invoice and an irrevocable advance payment security for the equivalent amount made out in favor of the Purchaser. The advance payment security may be reduced in proportion to the value of work performed by the Supplier as evidenced by the invoices for installation services.

Eighty percent (80%) of the measured value of work performed by the Supplier, as identified in the said Program of Performance, during the preceding month, as evidenced by the Purchaser’s authorization of the Supplier’s application, will be made monthly within sixty (60) days after receipt of invoice.

Five percent (5%) of the total or pro rata value of installation services performed by the Supplier as evidenced by the Purchaser’s authorization of the Supplier’s monthly applications, upon issue of the Completion Certificate, within sixty (60) days after receipt of invoice.

Five percent (5%) of the total or pro rata value of installation services performed by the Supplier as evidenced by the Purchaser’s authorization of the Supplier’s monthly applications, upon issue of the Operational Acceptance Certificate, within sixty (60) days after receipt of invoice.

Note:

1. **As per GCC Clause 29.7**, the Supplier’s obligation for a warranty shall be covered by either a retention money equivalent to at least five percent (5%) of the amount for each payment shall be retained by the Purchaser or the submission of a special bank guarantee equivalent to at least five percent (5%) of the Contract Price.

2. **The advance payment shall be paid through percentage deductions from the progress payment determined by the Engineer, provided that the advance payment shall be completely repaid prior to the time when 90 percent of the Contract amount has been certified for payment.**

| GCC 17.4 | The currencies for payments shall be Korean Won (KRW) for Foreign Currency Portion and Philippine Peso (PHP) for Local Currency Portion. |
| GCC 17.5 | The payment-delay period after which the Purchaser shall pay interest to the supplier shall be [insert number] days. The interest rate that shall be applied is [insert number] % |
| GCC 18.2 | All Taxes and Duty levied on Goods and installation/related services in the Philippines provided by the Suppliers for the implementation of the Project shall be borne by the Borrower. |
| GCC 19.1 | A Performance Security shall be required in the amount of ten percent (10%) of the Contract Price within fourteen (14) days of the notification of contract award. |
| GCC 19.3 | The Performance Security shall be in the form of a Bank Guarantee issued by a universal or commercial bank selected by the Supplier. If the institution issuing the security is located outside the country of the Purchaser, it shall be confirmed by a universal or commercial bank located in the Purchaser’s country to make it enforceable.  
If required, the Performance security shall be denominated in a freely convertible currency acceptable to the Purchaser or the currencies of payment of the Contract, in accordance with their portions of the Contract Price. |
| GCC 24.2 | The packing, marking and documentation within and outside the packages shall be in accordance with appropriate provisions of the Technical Specifications. |
| GCC 25.1 | The insurance coverage shall be pursuant to GCC Sub-Clause 25.1, the Supplier must insure the Goods in an amount equal to 110 percent of the CIP or EXW price of the Goods from “Warehouse” to “Project Site” on “All Risks” basis, including War Risks and Strikes. |
| GCC 25 | Add the following new Sub-clause after Sub-clause 25.1 |
| GCC 25.2 | The Supplier shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the additional insurances set forth below. The identity of the insurers and the form of the policies shall be subject to the approval of the Purchaser:  
(a) Installation All Risks Insurance  
Covering physical loss or damage to the facilities at the Site, occurring prior to Completion of the System, with an extended maintenance coverage for the Supplier’s liability in respect of any loss or damage occurring during the Defect Liability Period while the Supplier is on the Site for the purpose of performing its obligations during the Defect Liability Period.  
(b) Third Party Liability Insurance  
Covering bodily injury or death suffered by third parties including the Purchaser’s personnel, and loss of or damage to property occurring in connection with the supply and installation of the facilities.  
(c) Automobile Liability Insurance  
Covering use of all vehicles used by the Supplier or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract. |
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<tr>
<td><strong>(d) Workers’ Compensation</strong></td>
<td>In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.</td>
</tr>
<tr>
<td><strong>(e) Purchaser’s Liability</strong></td>
<td>In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.</td>
</tr>
</tbody>
</table>

The Purchaser shall be named as co-insured under all insurance policies taken out by the Supplier, except for the Third Party Liability, Workers’ Compensation and Purchaser’s Liability Insurances, and the Supplier’s Subcontractors shall be named as co-insureds under all insurance policies taken out by the Supplier except for the Cargo Insurance During Transport, Workers’ Compensation and Purchaser’s Liability Insurances. All insurer’s rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

The Supplier shall deliver to the Purchaser certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days’ notice shall be given to the Purchaser by insurers prior to cancellation or material modification of a policy.

The Supplier shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Supplier.

The Purchaser shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified (Insurance Requirements) to the Contract Agreement. The Supplier and its Subcontractors shall be named as co-insureds under all such policies. All insurers’ rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Purchaser shall deliver to the Supplier satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days’ notice shall be given to the Supplier by all insurers prior to any cancellation or material modification of the policies. If so requested by the Supplier, the Purchaser shall provide copies of the policies taken out by the Supplier.

If the Supplier fails to take out and/or maintain in effect the insurances, referred to above, the Purchaser may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Supplier under the Contract any premium that the Purchaser shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Supplier. If the Purchaser fails to take out and/or maintain in effect the insurances referred to above, the Supplier may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Purchaser under the Contract any premium that the Supplier shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Purchaser.
If the Supplier fails to or is unable to take out and maintain in effect any such insurances, the Supplier shall nevertheless have no liability or responsibility towards the Purchaser, and the Supplier shall have full recourse against the Purchaser for any and all liabilities of the Purchaser herein.

Unless otherwise provided in the Contract, the Supplier shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause, and all monies payable by any insurers shall be paid to the Supplier. The Purchaser shall give to the Supplier all such reasonable assistance as may be required by the Supplier. With respect to insurance claims in which the Purchaser’s interest is involved, the Supplier shall not give any release or make any compromise with the insurer without the prior written consent of the Purchaser. With respect to insurance claims in which the Supplier’s interest is involved, the Purchaser shall not give any release or make any compromise with the insurer without the prior written consent of the Supplier.

GCC 26.1 Responsibility for transportation of the Goods shall be as specified in the Incoterms.

GCC 27 Clause 27 is retitled as Inspections, Tests and Commissioning

GCC 27.1 The inspections and tests shall be as specified in the Technical Specifications.

GCC 27 Add the following Sub-clause 27.9

GCC 28.1 The liquidated damage shall be:

Applied if the Supplier fails to conduct the Flight Test and Commissioning within Fifteen (15) months as per the “1. Implementation Schedule of Section VI. (Schedule of Requirements)”. The applicable rate is one tenth (1/10) of one (1) percent of the cost of the unperformed portion for every day of delay.

GCC 28.1 The maximum amount of liquidated damages shall be: ten percent (10%).

Once the cumulative amount of liquidated damages reaches ten percent (10%) of the amount of the contract, the Purchaser shall rescind the contract, without prejudice to other courses of action and remedies open to it.

GCC 29.3 The Warranty shall remain valid for Thirty Six (36) months after the occurrence of Operational Acceptance.

For purposes of the Warranty, the place of final destination shall be:

Laguindingan Airport, Laguindingan, Misamis Oriental, Philippines

GCC 29.5 The period for repair or replacement shall be within ninety (90) days.

GCC 29 Add the following new Sub-clauses GCC 29.7 and GCC 29.8 after Sub-clause 29.6:
In order to assure that manufacturing defects shall be corrected by the Supplier, a warranty shall be required from the Supplier for a minimum period specified in GCC 29.3 of this SCC. The obligation for the warranty shall be covered by, at the Supplier’s option, either retention money in an amount equivalent to at least five percent (5%) of every progress payment, or a special bank guarantee equivalent to at least five percent (5%) of the Contract Price. The said amounts shall only be released after the lapse of the warranty period, provided, however, that the Supplies delivered are free from patent and latent defects and all the conditions imposed under this Contract have been fully met.

The Purchaser shall promptly notify the Supplier in writing of any claims arising under this warranty.

During the Defect Liability Period, the Supplier shall expeditiously undertake the repair works or replacement of defective parts, at the Supplier’s expense within ninety (90) days from the time the Purchaser has issued an order to undertake repair. In case of failure or refusal to comply with this mandate, the Purchaser shall undertake such repair works and shall be entitled to full reimbursement of expenses incurred therein upon demand.

During the first six (6) months of Operation Period which is within the Defects Liability Period, the following Supplier’s key personnel shall at least stay at Project Site to observe for any possible defects:

- (a) Chief Air Navigation Engineer
- (b) Chief Aeronautical Ground Lighting Engineer
- (c) Electrical Engineer

Payment for the above key personnel for the six (6) month stay (on full time basis) during operation period shall be incidental to other items of work, hence, will not be measured and paid separately.

Add the following new Sub-clauses after GCC 38

Cooperation with other Contractors at Site

The Supplier shall fully coordinate his activities with the work of the other Contractors (i.e. Civil Work Contractor) in Contract with the Purchaser at Site, whenever works are being done by the other Contractors which are contiguous or related to the work included in this Contract. The sequence of handling the work shall be such that the least delay possible will result to each Contractor and such sequence may be determined by the Engineer or the Purchaser’s Representative. The respective rights of the various interest involved shall be established by the Engineer in order to secure the completion of the various portions of the Work in general harmony.

The Supplier shall arrange his work and shall place and dispose of the materials being used so as not to interfere with the other Contractors within the limits of the same Project. He shall join his work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the other Contractors.
### GCC 40 Installation

**40.1 Setting Out/Supervision**

**40.1.1 Bench Mark**

(a) The Supplier shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Purchaser.

(b) If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Supplier shall forthwith notify the Engineer of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Engineer. If such error is based on incorrect data provided in writing by or on behalf of the Purchaser, the expense of rectifying the same shall be borne by the Purchaser.

**40.1.2 Supplier’s Supervision**

The Supplier shall give or provide all necessary superintendence during the installation of the Facilities, and its Project Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Supplier shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

**40.1.3 Labor:**

(a) The Supplier shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Supplier is encouraged to use local labor that has the necessary skills.

(b) Unless otherwise provided in the Contract, the Supplier shall be responsible for the recruitment, transportation, accommodation and catering of all labor, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.

(c) The Supplier shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located.
(d) The Supplier shall at its own expense provide the means of repatriation to all of its and its Subcontractor’s personnel employed on the Contract at the Site to their various home countries. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Supplier defaults in providing such means of transportation and temporary maintenance, the Purchaser may provide the same to such personnel and recover the cost of doing so from the Supplier.

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

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

40.2 Supplier’s Construction Equipment

40.2.1 All Supplier’s Construction Equipment brought by the Supplier onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Supplier shall not remove the same from the Site without the Engineer’s consent that such Supplier’s Construction Equipment is no longer required for the execution of the Contract.

40.2.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Supplier shall remove from the Site all Equipment brought by the Supplier onto the Site and any surplus materials remaining thereon.

40.2.3 The Purchaser will, if requested, use its best endeavors to assist the Supplier in obtaining any local, state or national government permission required by the Supplier for the export of the Supplier’s Construction Equipment imported by the Supplier for use in the execution of the Contract that is no longer required for the execution of the Contract.

40.3 Site Regulations and Safety

The Purchaser and the Supplier shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Supplier shall prepare and submit to the Purchaser, with a copy to the Engineer, proposed Site regulations for the Purchaser’s approval, which approval shall not be unreasonably withheld.
Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

40.4 Opportunities for Other Contractors

40.4.1 The Supplier shall, upon written request from the Purchaser or the Engineer, give all reasonable opportunities for carrying out the work to any other contractors employed by the Purchaser on or near the Site.

40.4.2 If the Supplier, upon written request from the Purchaser or the Engineer, makes available to other contractors any roads or ways the maintenance for which the Supplier is responsible, permits the use by such other contractors of the Supplier’s Construction Equipment, or provides any other service of whatsoever nature for such other contractors, the Purchaser shall fully compensate the Supplier for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Supplier reasonable remuneration for the use of such equipment or the provision of such services.

40.4.3 The Supplier shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Engineer shall determine the resolution of any difference or conflict that may arise between the Supplier and other contractors and the workers of the Purchaser in regard to their work.

40.4.4 The Supplier shall notify the Engineer promptly of any defects in the other contractors’ work that come to its notice, and that could affect the Supplier’s work. The Engineer shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by the Engineer shall be binding on the Supplier.

40.5 Emergency Work

If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Supplier shall immediately carry out such work.

If the Supplier is unable or unwilling to do such work immediately, the Purchaser may do or cause such work to be done as the Purchaser may determine is necessary in order to prevent damage to the Facilities. In such event the Purchaser shall, as soon as practicable after the occurrence of any such emergency, notify the Supplier in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Purchaser is work that the Supplier was liable to do at its own expense under the Contract, the reasonable costs incurred by the Purchaser in connection therewith shall be paid by the Supplier to the Purchaser. Otherwise, the cost of such remedial work shall be borne by the Purchaser.
40.6 Site Clearance

40.6.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Supplier shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Supplier’s Construction Equipment no longer required for execution of the Contract.

40.6.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Supplier shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities clean and safe.

40.7 Watching and Lighting

The Supplier shall provide and maintain at its own expense all lighting, fencing (if required), and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

40.8 Work at Night and on Holidays

40.8.1 Unless otherwise provided in the Contract, no work shall be carried out during the night and on public holidays of the country where the Site is located without prior written consent of the Purchaser, except where work is necessary or required to ensure safety of the Facilities or for the protection of life, or to prevent loss or damage to property, when the Supplier shall immediately advise the Engineer, provided that provisions of this GCC Sub-Clause 40.8.1 shall not apply to any work which is customarily carried out by rotary or double-shifts.

40.8.2 Notwithstanding GCC Sub-Claus 40.8.1 or 40.1.3, if and when the Supplier considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Purchaser’s consent thereto, the Purchaser shall not unreasonably withhold such consent.
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<th>GCC 41</th>
<th>Work Program</th>
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<tr>
<td><strong>41.1 Program of Performance</strong></td>
<td>Within twenty-eight (28) days after the date of signing the Contract Agreement, the Supplier shall prepare and submit to the Project Manager a detailed program of performance of the Contract, made in the form specified in the SCC and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and commission the Facilities, as well as the date by which the Supplier reasonably requires that the Purchaser shall have fulfilled its obligations under the Contract so as to enable the Supplier to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Supplier shall accord with the Time Schedule included in the corresponding Appendix (Time Schedule) to the Contract Agreement and any other dates and periods specified in the Contract. The Supplier shall update and revise the program as and when appropriate or when required by the Engineer, but without modification in the Times for Completion given in the SCC and any extension granted in accordance with GCC Clause 35, and shall submit all such revisions to the Engineer.</td>
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<td><strong>41.2 Progress Report</strong></td>
<td>The Supplier shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 41.1 above, and supply a progress report to the Engineer every month. The progress report shall be in a form acceptable to the Engineer and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.</td>
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<td><strong>41.3 Progress of Performance</strong></td>
<td>If at any time the Supplier’s actual progress falls behind the program referred to in GCC Sub-Clause 41.1, or it becomes apparent that it will so fall behind, the Supplier shall, at the request of the Purchaser or the Engineer, prepare and submit to the Engineer a revised program, taking into account the prevailing circumstances, and shall notify the Engineer of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 8.2, any extension thereof entitled under GCC Sub-Clause 40.1, or any extended period as may otherwise be agreed upon between the Purchaser and the Supplier.</td>
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<tr>
<td><strong>41.4 Work Procedures</strong></td>
<td>The Contract shall be executed in accordance with the Contract Documents and the approved Work Procedures submitted by the Supplier.</td>
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<td>41.5</td>
<td>The Supplier may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.</td>
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**GCC 42**

**Completion of the Facilities**

42.1 As soon as the Facilities or any part thereof has, in the opinion of the Supplier, been completed operationally and structurally and put in a tight and clean condition as specified in the Technical Specifications, excluding minor items not materially affecting the operation or safety of the Facilities, the Supplier shall so notify the Purchaser thru the Engineer in writing.

42.2 The Engineer shall, within fourteen (14) days after receipt of the Supplier’s notice under GCC Sub-Clause 42.1, either issue a Completion Certificate, stating that the Facilities or that part thereof have reached Completion as of the date of the Supplier’s notice under GCC Sub-Clause 42.1, or notify the Supplier in writing of any defects and/or deficiencies.

42.3 If the Engineer notifies the Supplier of any defects and/or deficiencies, the Supplier shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 42.2. If the Engineer is satisfied that the Facilities or that part thereof have reached Completion, the Engineer shall, within seven (7) days after receipt of the Supplier’s repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Supplier’s repeated notice. If the Engineer is not so satisfied, then it shall notify the Supplier in writing of any defects and/or deficiencies within seven (7) days after receipt of the Supplier’s repeated notice, and the above procedure shall be repeated.

42.4 If the Engineer fails to issue the Completion Certificate and fails to inform the Supplier of any defects and/or deficiencies within fourteen (14) days after receipt of the Supplier’s notice under GCC Sub-Clause 42.2 or within seven (7) days after receipt of the Supplier’s repeated notice under GCC Sub-Clause 42.5, or if the Purchaser makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Supplier’s notice or repeated notice, or as of the Purchaser’s use of the Facilities, as the case may be.

42.5 As soon as possible after Completion, the Supplier shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Purchaser will undertake such completion and deduct the costs thereof from any monies owing to the Supplier.

42.6 Upon Completion, the Purchaser shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.
**GCC 43**

**Commissioning and Operational Acceptance**

43.1 Commissioning

43.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Supplier immediately after issue of the Completion Certificate by the Engineer, pursuant to GCC Sub-Clause 42.2, or immediately after issue of the deemed Completion, under GCC Sub-Clause 42.4.

43.1.2 The Purchaser shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning.

43.2 Operational Acceptance

43.2.1 Subject to GCC Sub-Clause 43.2 below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when:

(a) the Flight Test and Commissioning has been successfully completed and the Guarantees are met; or

(b) the Supplier has paid the liquidated damages specified in GCC Sub-Clause 28 hereof; and

(c) any minor items mentioned in GCC Sub-Clause 42.5 hereof relevant to the Facilities or that part thereof have been completed.

43.2.2 At any time after any of the events set out in GCC Sub-Clause 43.2.1 have occurred, the Supplier may give a notice to the Engineer requesting the issue of an Operational Acceptance Certificate in the form provided in the Bidding Documents or in another form acceptable to the Purchaser in respect of the Facilities or the part thereof specified in such notice as of the date of such notice.

43.2.3 The Engineer shall, after consultation with the Purchaser, and within seven (7) days after receipt of the Supplier’s notice, issue an Operational Acceptance Certificate.

43.2.4 If within seven (7) days after receipt of the Supplier’s notice, the Engineer fails to issue the Operational Acceptance Certificate or fails to inform the Supplier in writing of the justifiable reasons why the Engineer has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Supplier’s said notice.
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Contract Form 1. Contract Agreement

[The successful Bidder shall fill in this form in accordance with the instructions indicated]

THIS CONTRACT AGREEMENT is made

the [insert: number] day of [insert: month], [insert: year].

BETWEEN

(1) [insert complete name of Purchaser], a [insert description of type of legal entity, for example, an agency of the Ministry of .... of the Government of [insert name of Country of Purchaser], or corporation incorporated under the laws of [insert name of Country of Purchaser] and having its principal place of business at [insert address of Purchaser] (hereinafter called “the Purchaser”), and

(2) [insert name of Supplier], a corporation incorporated under the laws of [insert: country of Supplier] and having its principal place of business at [insert: address of Supplier] (hereinafter called “the Supplier”).

WHEREAS the Purchaser invited bids for certain Goods and ancillary services, viz., [insert brief description of Goods and Services] and has accepted a Bid by the Supplier for the supply of those Goods and Services in the sum of [insert Contract Price in words and figures, expressed in the Contract currency(ies)] (hereinafter called “the Contract Price”):

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract referred to.

2. The following documents shall constitute the Contract between the Purchaser and the Supplier, and each shall be read and construed as an integral part of the Contract:

   (a) This Contract Agreement
   (b) Special Conditions of Contract
   (c) General Conditions of Contract
   (d) Technical Requirements (including Schedule of Requirements and Technical Specifications)
   (e) The Supplier’s Bid and original Price Schedules
   (f) The Purchaser’s Notification of Award
   (g) [Add here any other document(s)]

3. This Contract shall prevail over all other Contract documents. In the event of any discrepancy or inconsistency within the Contract documents, then the documents shall prevail in the order listed above.

4. In consideration of the payments to be made by the Purchaser to the Supplier as hereinafter mentioned, the Supplier hereby covenants with the Purchaser to provide the Goods and Services and to remedy defects therein in conformity in all respects with the provisions of the Contract.
Section IX. Contract Forms

5. The Purchaser hereby covenants to pay the Supplier in consideration of the provision of the Goods and Services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of [insert the name of the Contract governing law country] on the day, month and year indicated above.

For and on behalf of the Purchaser

Signed: [insert signature]
in the capacity of [insert title or other appropriate designation]
in the presence of [insert identification of official witness]

For and on behalf of the Supplier

Signed: [insert signature of authorized representative(s) of the Supplier]
in the capacity of [insert title or other appropriate designation]
in the presence of [insert identification of official witness]
Contract Form 2. Performance Security

[The bank, as requested by the successful Bidder, shall fill in this form in accordance with the instructions indicated]

Date: [insert date (as day, month, and year) of Bid Submission]

CB No. and title: [insert no. and title of bidding process]

Bank’s Branch or Office: [insert complete name of Guarantor]

Beneficiary: [insert complete name of Purchaser]

PERFORMANCE GUARANTEE No.: [insert Performance Guarantee number]

We have been informed that [insert complete name of Supplier] (hereinafter called “the Supplier”) has entered into Contract No. [insert number] dated [insert day and month], [insert year] with you, for the supply of [description of Goods and related Services] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a Performance Guarantee is required.

At the request of the Supplier, we hereby irrevocably undertake to pay you any sum(s) not exceeding [insert amount(s) in figures and words] upon receipt by us of your first demand in writing declaring the Supplier to be in default under the Contract, without cavil or argument, or your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This Guarantee shall expire no later than the [insert number] day of [insert month] [insert year], and any demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458, except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.

[signatures of authorized representatives of the bank and the Supplier]

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10 The Bank shall insert the amount(s) specified in the SCC and denominated, as specified in the SCC, either in the currency(ies) of the Contract or a freely convertible currency acceptable to the Purchaser.

11 Dates established in accordance with Sub-Clause 19.4 of the General Conditions of Contract (“GCC”), taking into account any warranty obligations of the Supplier under Sub-Clause 17.2 of the GCC intended to be secured by a partial Performance Guarantee. The Purchaser should note that in the event of an extension of the time to perform the Contract, the Purchaser would need to request an extension of this Guarantee from the Bank. Such request must be in writing and must be made prior to the expiration date established in the Guarantee. In preparing this Guarantee, the Purchaser might consider adding the following text to the Form, at the end of the penultimate paragraph: “We agree to a one-time extension of this Guarantee for a period not to exceed [six months] [one year], in response to the Purchaser’s written request for such extension, such request to be presented to us before the expiry of the Guarantee.”
ENDORSEMENT BY A UNIVERSAL OR COMMERCIAL BANK IN THE PHILIPPINES*

We (name of a commercial bank in Philippines) …………………………………………………
(hereinafter called “the Endorser”) certify that “the Bank” is a solvent financial institution of
good reputation. We hereby agree to stand as guarantor for “the Bank” and shall meet the
contractual obligations of “the Bank” in the event “the Bank” fails to meet the requirements of
this “Bank Guarantee”.

DATE    SIGNATURE OF THE BANK ACTING AS THE
ENDORSER

SEAL …………………………………………………

DATE    SIGNATURE OF THE WITNESS

NAME OF THE WITNESS ……………………………

ADDRESS ……………………………………………

* Not required if a Philippine Universal or Commercial Bank issues the Performance
Security.
Contract Form 3. Bank Guarantee for Advance Payment

[The bank, as requested by the successful Bidder, shall fill in this form in accordance with the instructions indicated.]

Date: [insert date (as day, month, and year) of Bid Submission]

CB No. and title: [insert number and title of bidding process]

[bank’s letterhead]

Beneficiary: [insert legal name and address of Purchaser]

ADVANCE PAYMENT GUARANTEE No.: [insert Advance Payment Guarantee no.]

We, [insert legal name and address of bank], have been informed that [insert complete name and address of Supplier] (hereinafter called “the Supplier”) has entered into Contract No. [insert number] dated [insert date of Agreement] with you, for the supply of [insert types of Goods to be delivered] (hereinafter called “the Contract”).

Furthermore, we understand that, according to the conditions of the Contract, an advance is to be made against an advance payment guarantee.

At the request of the Supplier, we hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of [insert amount(s) in figures and words] upon receipt by us of your first demand in writing declaring that the Supplier is in breach of its obligation under the Contract because the Supplier used the advance payment for purposes other than toward delivery of the Goods.

It is a condition for any claim and payment under this Guarantee to be made that the advance payment referred to above must have been received by the Supplier on its account [insert number and domicile of the account]

This Guarantee shall remain valid and in full effect from the date of the advance payment received by the Supplier under the Contract until [insert date].

This Guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.

____________________
[signature(s) of authorized representative(s) of the bank]

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12 The bank shall insert the amount(s) specified in the SCC and denominated, as specified in the SCC, either in the currency(ies) of the Contract or a freely convertible currency acceptable to the Purchaser.

13 Insert the expected expiration date of the time for completion as stipulated in the Implementation Schedule. The Purchaser should note that in the event of an extension of the time to perform the Contract, the Purchaser would need to request an extension of this Guarantee from the bank. Such request must be in writing and must be made prior to the expiration date established in the Guarantee. In preparing this Guarantee, the Purchaser might consider adding the following text to the Form, at the end of the penultimate paragraph: “We agree to a one-time extension of this Guarantee for a period not to exceed [six months][one year], in response to the Purchaser’s written request for such extension, such request to be presented to us before the expiry of the Guarantee.”
Contract Form 4. Form of Completion Certificate

Contract: [insert name of contract and contract identification details . . . .]

Date: ........................................

Certificate No.: ........................................

To: [insert name and address of Supplier . . . .]

Dear Ladies and/or Gentlemen,

Pursuant to GC Clause 42 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Purchaser dated [insert date . . . .], relating to the [brief description of the Facilities . . . .], we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Purchaser hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: [description . . . .]

2. Date of Completion: [date . . . .]

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[Signature . . . .]

Engineer
Contract Form 5. Form of Operational Acceptance Certificate

Contract: [insert name of contract and contract identification details. . . .]

Date: ........................................
Certificate No.: ........................................

To: [insert name and address of Supplier. . . .]

Pursuant to GC Sub-Clause 43.2 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Purchaser dated [date], relating to the [brief description of the Facilities], we hereby notify you that the required Commissioning Flight Test of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: [description]
2. Date of Operational Acceptance: [date]

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[. . .Signature. . . .]

Engineer
Price Schedules

Procurement of Air Navigation System and Support Facilities for the Laguindingan Airport

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:
   - Grand Summary
   - Schedule No. 1: Goods Manufactured Outside the Purchaser’s Country, to be Imported
   - Schedule No. 2: Goods Manufactured Outside the Purchaser’s Country, already Imported (Not Applicable)
   - Schedule No. 3: Goods offered in the Purchaser’s Country
   - Schedule No. 4: Related Services/Installation
   - Schedule No. 5: Taxes and Duty
   - Schedule No. 6: Summary

2. The Schedules do not generally give a full description of the equipment to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Purchaser’s Requirements and other sections of the issued Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If Supplier is unclear or uncertain as to the scope of any item, it shall seek clarification in accordance with ITB 7 prior to submitting its Proposal.

Pricing

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Supplier.

   As specified in the Bid Data Sheets and Special Conditions of Contract, Prices quoted by the Supplier shall be fixed and not subject to variation on any account as well as not subject to price adjustment during the performance of the contract.

5. Prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders of the Bidding Documents.

   For each item, Supplier shall complete each appropriate column in the respective Schedules, giving the price as indicated in the Schedules.
Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in the Technical Specifications or elsewhere in the Bidding Document.

Payment made for each individual item of the Price Schedule which is stated in “Lot” shall be the full and complete compensation for all work related to the item, whether specifically stated, implied or otherwise inferred elsewhere in the Contract Documents, particularly as indicated in the Technical Specification and Drawings. It is the liability of the Supplier to conduct full assessment of the Drawings and Specifications provided in order that there would not be a missing item in the future for all “Lot” items.

It is also the responsibility of the Bidder to check on the plans (particularly those work component interfacing with civil works which will be undertaken by the existing civil work contractor) and the technical specifications of the items corresponding to the breakdown of lump sum bid which the Bidder will submit under Price Proposal Form 3 (Breakdown of Lump Sum Bid Items). Discrepancy on the quantities provided on the Price Proposal Form 3 (Breakdown of Lump Sum Bid Items) and that of quantities referred/shown on the plans shall not, in any way, be a ground for variation in the future.

6. Payments will be made to the Supplier in the currency or currencies indicated under each respective item.