



ABU DHABI SEWERAGE SERVICES COMPANY (ADSSC)

GENERAL SPECIFICATION FOR ELECTRICAL WORKS

DIVISION 16 ELECTRICAL

SECTION 16160 PACKAGE TYPE UNIT SUBSTATION

ADSSC/GSEW	Division 16	Section 16160	Package Type Unit Substation	Rev: 01	April 2008	Page 1 of 20
------------	-------------	---------------	---------------------------------	---------	------------	--------------

DOCUMENT CONTROL SHEET

Revision No.	Date	Revision Description / Purpose of Issue
01	April 2008	First Issue.
02		
03		
04		
05		
06		
07		
08		
09		
10		

TABLE OF CONTENTS

1.	GENERAL REQUIREMENTS	5
1.1	SCOPE	5
1.2	SYSTEM CHARACTERISTICS	5
1.3	REFERENCE STANDARDS.....	5
1.3.1	HV SWITCHGEAR:.....	5
1.3.2	TRANSFORMER	6
1.3.3	LV EQUIPMENT	6
1.3.4	COMPLETE PACKAGE SUBSTATION	6
1.4	ALTERNATIVE CODES AND STANDARDS	6
1.5	PRECEDENCE OF CODES AND STANDARDS	7
2.	DESIGN AND CONSTRUCTION	7
2.1	GENERAL ARRANGEMENT AND LAYOUT	7
2.1.1	CONFIGURATION.....	7
2.1.2	LAY OUT	8
2.1.3	ELECTRICAL CONNECTION.....	8
2.1.4	EARTHING ARRANGEMENT	8
2.1.5	INTERNAL LIGHTING	9
2.1.6	VENTILATION	9
2.1.7	ACCESS TO UNIT	9
2.1.8	NOISE LEVEL.....	9
2.1.9	MOUNTING ARRANGEMENT	9
2.1.10	LIFTING LUGS	9
2.2	11KV RING MAIN UNIT (RMU).....	10
2.2.1	GENERAL.....	10
2.2.2	RATING	10
2.2.3	11KV SWITCHGEAR	10
2.2.4	INTERLOCKS.....	11
2.2.5	LOCKS.....	12
2.2.6	CABLE TERMINATIONS	12
2.2.7	FAULT CURRENT INDICATOR	12
2.2.8	ACCESSORIES.....	12
2.3	TRANSFORMER	13
2.4	DUCT TYPE / FLANGE CONNECTED DISTRIBUTION FEEDER PILLAR	13
2.4.1	GENERAL.....	13
2.4.2	SUPPORTS	13
2.4.3	CABLES, GLANDS AND LUGS	14
2.4.4	USE WAYS AND FUSES	14
2.5	DETAILS OF EQUIPMENT	14
2.5.1	BUSBARS.....	14
2.5.2	INCOMING UNIT	15
2.5.3	AMMETERS	15
2.5.4	VOLTMETER	15
2.5.5	EARTH BAR	15
2.5.6	WIRING	15
2.5.7	BASE PLATE	15

2.5.8	NUTS AND BOLTS	15
2.5.9	RATINGS	16
2.6	PACKAGE UNIT HOUSING	16
2.6.1	METALLIC HOUSING	16
2.6.2	FLOOR AND ROOF	16
2.6.3	WALLS	17
2.6.4	DOORS	17
2.6.5	CABLE ENTRIES	17
2.7	INSPECTION AND TESTS	17
2.7.1	HV SWITCHGEAR	18
2.7.2	TRANSFORMER	18
2.7.3	LV SWITCHGEAR	18
2.7.4	COMPLETE PACKAGE SUBSTATION	18
2.8	DOCUMENTATION AND ENGINEERING DATA	19

1. GENERAL REQUIREMENTS

1.1 SCOPE

- a) All items described within this section shall comply with the provisions of Section 15001: General M&E Requirements.
- b) The scope of works covers design, manufacture and supply of 11/0.415kV Package Type Unit Substation for operation on the Abu Dhabi Distribution Company (ADDC) 11kV Distribution Network.
- c) The 11kV switchgear shall be designed and manufactured to BS EN 60694 (IEC 60694), BS EN 62271-200 (IEC 62271-200) or other approved standards to meet the latest ADDC specifications.
- d) It is deemed mandatory for the manufacturer to have valid ISO 9000 series Certification issued by an Internationally Recognised Agency of West Europe, USA or Japan and should have been tested in a Recognised Independent Testing Laboratory as per the relevant IEC standards, including "Short Circuit Withstand Tests".
- e) The manufacturer shall have documented supply record of similar equipment working satisfactorily in the same climatic and service conditions for the last five (5) years as a minimum prerequisite to submit their offer.
- f) The equipment shall be installed in a non air-conditioned room without any forced ventilation duty at the ambient conditions specified in Section 15001: General M&E Requirements.

In addition, the substation shall be capable of withstanding the effects of direct solar radiation at the installed locations. The temperature of metal surfaces exposed to direct solar radiation and the air temperature inside non-ventilated metal enclosures shall be regarded 90°C, with the additional effect of any internal heating.

1.2 SYSTEM CHARACTERISTICS

The characteristics of the system are defined in Section 15001: General M&E Requirements.

1.3 REFERENCE STANDARDS

1.3.1 HV SWITCHGEAR:

IEC 60694 Common specifications for high-voltage switchgear and controlgear standards

- IEC 62271-200 High-voltage switchgear and controlgear. AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV
- IEC 62271-102 High-voltage switchgear and controlgear. Alternating current disconnectors and earthing switches
- IEC 60529 Classification of Degree of Protection provided by Enclosures.

1.3.2 TRANSFORMER

- IEC 60076 Power Transformers. BS 171
- IEC 60137 Insulated bushings for alternating voltages above 1000V
- IEC 60296 Fluids for electrotechnical applications. Unused mineral insulating oils for transformers and switchgear
- IEC 60354 Guide to loading of oil-immersed power transformers
- IEC 60076-10 Power transformers. Determination of sound levels

1.3.3 LV EQUIPMENT

- BS EN 60947-1 Low-voltage switchgear and controlgear. General rules
- IEC 60044-3 Instrument transformers. Combined transformers
- IEC 60439 Low-voltage switchgear and controlgear assemblies.
- IEC 60269-4 Low-voltage fuses. Supplementary requirements for fuse-links for the protection of semiconductor devices (BS 88-4)

1.3.4 COMPLETE PACKAGE SUBSTATION

- BS EN 62271-202 High-voltage switchgear and controlgear. Part 202: High voltage/low voltage prefabricated substation

1.4 ALTERNATIVE CODES AND STANDARDS

The Contractor may propose alternative codes and standards provided it is demonstrated that they give an equivalent degree of quality those referenced above. Acceptability of any alternative is at the discretion of ADSSC.

1.5 PRECEDENCE OF CODES AND STANDARDS

- a) In case of conflict between this specification and any of the referenced Codes and Standards, the following order of precedence shall apply:
 - i. This Specification.
 - ii. Referenced Codes and Standards.
 - iii. Acceptable Alternative Codes and Standards.
- b) The Contractor shall note that compliance of the manufacturer with the provision of this specification does not relieve him of his responsibility to supply the equipment and accessories of proper design, electrically and mechanically suited to meet the operating guarantees at the specified service conditions.

2. DESIGN AND CONSTRUCTION

2.1 GENERAL ARRANGEMENT AND LAYOUT

2.1.1 CONFIGURATION

- a) The Unit Type Substation shall consist of a fully SF6 Insulated 11kV Ring Main Unit (RMU) with an 11/0.433kV 2,000, 1,500, 1,000 or 500kVA hermetically-sealed transformer and a 415/240V Distribution Feeder Pillar.
- b) All the equipment shall be outdoor type, interconnected, factory assembled as an integral unit, mounted upon a galvanised steel base frame, housed in an approved vandal-proof and Aluzinc metallic housing, ready for placing into position upon a prepared surface.
- c) Lifting lugs shall be provided so that the completely assembled package substation may be lifted without damage. The design shall be such that the roof shall be removable to allow easy lifting of any major part of the unit. The metallic ceiling shall be of a double roofing system to diminish heating due to solar radiation.
- d) The transformer, LV and MV compartments shall be completely separated by Aluzinc steel sheets. The transformer shall be located in the middle of the substation while the MV and LV compartments are located at both ends of the substation adjacent to the corresponding bushing of the transformer. The barrier between the MV switchgear and the transformer shall be provided with a pressure relief flap.
- e) A small door to access the transformer tap changer and the thermometer shall be provided on either LV or HV separator.
- f) The surface colour of HV and LV Switchgear, Transformer and Housing shall be RAL 7032 light grey.

- g) The Unit shall be delivered fully assembled and tested.

2.1.2 LAY OUT

The layout shall enable all electrical, operating and maintenance work to be carried out with ease and without difficulty. The activities listed below shall be easily executed and access to carry out such activities shall be considered during the design stage.

Components	Activity
Transformer	<ul style="list-style-type: none"> • Reading Name Plate Details. • Termination of 11kV Cable. • Tap Changer Operation. • Oil Sampling and Re-filling.
HV Switchgear	<ul style="list-style-type: none"> • Switchgear Operation. • HV Testing. • Jointing of cable and connections.
LV Panel	<ul style="list-style-type: none"> • Fuse Changing. • Load reading on each phase of LV using a Clip-on Ammeter.
All Components	<ul style="list-style-type: none"> • Easy Removal and Replacement.

2.1.3 ELECTRICAL CONNECTION

- a) Electrical connections to the transformer shall be so designed that they may be disconnected and reconnected at site to facilitate the removal of any major component of the unit.
- b) The inter-connection between 11kV Switchgear and Transformer Terminals Bushings shall be by means of 95/70mm² single-core, XLPE-insulated, copper cable with plug-in type connection, of an acceptable make.
- c) The connection between transformer LV bushing and the feeder pillar shall be by means of flexible copper busbars passing through an air-insulated duct/flange.

2.1.4 EARTHING ARRANGEMENT

- a) Each unit substation assembly shall be provided with a copper earth bar of minimum size 40x6mm to which the transformers' LV neutral and metal frames of all items: HV switchgear, transformer and feeder pillar shall be connected. Two earth terminals shall be provided for connection to the external earthing system.

- b) All substation metalwork, including transformer tank, cable screens, feeder pillar, doors and any internal structural steelwork shall be securely bonded together.
- c) The metalwork earthing terminal shall be provided in an accessible position, the position of which shall be shown on the appropriate tender drawing, and shall be approved by ADSSC.
- d) Two bolted (removable) links shall be provided in the LV feeder pillar between the transformer neutral and neutral busbar and between the neutral bar and the earth bar.

2.1.5 INTERNAL LIGHTING

HV, LV and Transformer compartments shall each be fitted with appropriate lighting, controlled via a door-operated switch.

2.1.6 VENTILATION

Adequate ventilation for natural circulation of air shall be provided to keep the inside temperature within the limit. Ventilation apertures shall be suitably screened and louvered to prevent the entry of vermin, dust and other foreign bodies.

2.1.7 ACCESS TO UNIT

Access to the unit shall be by double-hinged and triple-latched doors fitted on opposite sides of the package unit, and at least one door fitted on one side of the transformer compartment.

2.1.8 NOISE LEVEL

The noise level of the completely assembled package substation shall not exceed 70db(A) @ 1m in accordance with IEC 60076-10. The package substation shall be checked after assembly to ensure that no rattling of individual components can occur.

2.1.9 MOUNTING ARRANGEMENT

The package substation shall not require the casting of a concrete plinth at site. Site preparation shall be limited to levelling only.

2.1.10 LIFTING LUGS

Lifting lugs shall be provided so that the completely assembled package substation may be lifted without damage. The lifting lugs shall be designed to carry the weight of the substation complete with transformer and switchgear. Lifting spread beams shall be supplied with the units as required.

2.2 11KV RING MAIN UNIT (RMU)

2.2.1 GENERAL

- a) The RMU shall consist of two fault-making and load-breaking Ring Circuit Switches (Feeder Control) and one Tee Off circuit breaker for Transformer Protection, all equipped with "ON", "OFF" and "EARTH" position, SF6 Insulated connected to common Busbars and contained in a common tank.
- b) The entire unit shall be mounted on a skid base capable of being moved and hauled as a single unit. The unit shall be "NON-EXTENSIBLE" type metal enclosed and suitable for outdoor installation.
- c) The switchgear shall be sealed for life and be less than IP54. The spring mechanisms shall be of long-life corrosion-resistant material and dust proof. The galvanised and powder-coated sheet steel housing and the cable connection compartments shall provide long life protection against corrosion.

2.2.2 RATING

- a) The continuous current rating of the unit shall be as follows:
 - i. Feeder Control Switch 400A.
 - ii. Transformer Circuit Breaker 200A.
- b) The unit shall be rated as follows:
 - i. Rated short time current 20kA for 1 second.
 - ii. Rated Making current 50kA.
 - iii. Insulation level 22kV.
 - iv. Power frequency withstand voltage 28kV for 1 minute.
 - v. Impulse withstand voltage 75kV.

2.2.3 11KV SWITCHGEAR

2.2.3.1 Feeder Control Unit:

The Feeder Control Switches shall be load-breaking fault-making SF6 insulated having independent manual anti-reflex feature in the operating mechanism/handle. Integral means shall be provided for cable earthing and cable testing. Disconnection of cables for testing purpose is not acceptable.

2.2.3.2 TRANSFORMER CONTROL UNIT:

The Transformer Control Unit shall be a fault-making and fault-breaking Tee Off circuit breaker. The vacuum/SF6 circuit breaker shall be equipped with OC/SC and E/F protective relay that shall not require auxiliary power and

shall be adjustable to suit different transformer capacities. The CB shall have a trip coil connected to the high-high temperature switch of the transformer to protect the transformer against over loading. Details of the tripping mechanism, tripping characteristics of the relay and the applicable settings shall be submitted with the offer.

2.2.3.3 Operating Mechanism

The operating mechanism of the switches shall be arranged for spring-assisted hand operation, whereby the speeds of make and break are independent of the operator. A MOTORISED OPERATING MECHANISM WITH THE ADDITIONAL POSSIBILITY OF REMOTE OPERATION SHALL BE OFFERED AS AN OPTION.

2.2.3.4 INDICATORS

Clear indicators showing "ON", "OFF" and "EARTH" shall be provided.

2.2.3.5 TEST FACILITIES

Each switch shall be provided with facilities for applying high voltage tests and injection current tests on the ring main cable connected to the switch and this shall be effected by insertion of a three phase test plug when the switch is in the 'EARTH ON' position, to become effective when the switch is in the 'OFF' position.

The testing facilities shall provide for the attachment of test connection external to the switch equipment and shall be capable of withstanding the test requirements of IEC 62271-200.

Three phase testing devices suitable for use with any of the switches shall be provided. Each testing device shall be enclosed in a suitable lockable container marked with the contents.

Test access covers shall be provided with locking facilities

2.2.4 INTERLOCKS

- a) Interlocks of the mechanical, positively-driven type shall be provided to prevent the following operations:
 - i. Inadvertent operation of a switch directly from the 'ON' position to the 'EARTH ON' position.
 - ii. Opening of the testing access when the switch equipment is in any other than the 'EARTH ON' position.
 - iii. The testing device being inserted or withdrawn when the switch equipment is in any other than the 'EARTH ON' position.
 - iv. The movement of the switch from the 'EARTH ON' to the 'OFF' position with the testing access open and the testing device removed.

- v. The movement of the switch to the 'ON' position when the testing access is open, whether or not the testing device has been inserted.
- vi. Operation of the switch from 'ON' to 'OFF' or the switch or fuse-switch from the 'EARTH ON' to 'OFF' immediately after the achievement of the 'ON' or 'EARTH ON' positions respectively.
- vii. Operation of the switch from "EARTH ON" to "OFF" immediately after achievement of the 'EARTH ON' position.
- viii. Application of the earth links while the switch is in the 'ON' position.
- ix. The switch is being moved to the 'ON' position while earth links are applied.

2.2.5 LOCKS

The operating mechanism shall be lockable at each position with padlocks, having 5mm diameter hasp with 25mm clearance. The padlock need not be supplied. An Operating handle shall be supplied with each unit.

2.2.6 CABLE TERMINATIONS

- a) Cable boxes for ring circuits shall be suitable for accommodating 3-core XLPE-insulated, PVC-sheathed, galvanised steel tape-armoured and PVC-served cable with copper conductors over the range of 185mm² to 240mm².
- b) Heat-shrinkable termination kits, of an acceptable make, shall be supplied with the box. They shall be designed for air insulated dry type heat shrinkable termination. The design shall provide sufficient space for crossing of cores without damage to core insulations, Cable glands and unit.
- c) For transformer control switch, plug-in type terminations suitable for 70mm² single core cable shall be supplied.

2.2.7 FAULT CURRENT INDICATOR

- a) Through-fault current indicators with core-balance transformer (associated with the one of the feeders) shall be supplied. They shall be supplied fixed flush-mounted on units facing glass windows on the package unit access door, in such a way that they can be seen without opening the door.
- b) The through fault current indicator shall operate on the passage of fault current through its core-balance C.T. The indicator shall be clearly visible from ground level. The unit shall be of the manual reset type.

2.2.8 ACCESSORIES

- a) Each unit shall be supplied with the following accessories:

- i. Voltage Indicator lamps fixed on the front of the panel for both feeder switches.
- ii. Plug-in Voltage Indicator for phase comparison.
- iii. Test Plugs with each batch of 10 (ten) Units.

2.3 TRANSFORMER

Transformers shall comply with Section 16150: Power Distribution Transformers.

2.4 DUCT TYPE / FLANGE CONNECTED DISTRIBUTION FEEDER PILLAR

2.4.1 GENERAL

- a) The 415/240V Distribution Feeder Pillars shall be metalclad with NH Size 3 load break, 3 x 1-pole switching strip fuse-ways to DIN 43623, with positive operation contact and downward connections at the bottom of the fuse-way.
- b) Insertion of NH-type fuse cartridge shall be completely safe. Guides of high thermally-stable insulating material shall be provided to ensure adequate protection against accidental contact. Under all the circumstances, the fuse blade shall pass through the wraparound / insulated arc chutes before the contact is made. All the strip fuseways shall have their live terminals shrouded to avoid accidental contact at the time of replacing fuse. The fuse strips shall have interphase barriers and blank labels for feeder identification.
- c) The metallic enclosure shall be of sheet steel with thickness not less than 3mm and shall be galvanized to BS EN ISO 1461 or other equivalent standard. The feeder pillar then shall be painted in accordance with acceptable standards.
- d) The equipment offered shall have been tested at a recognised testing Laboratory up to 46kA RMS for one second. A short-circuit test certificate should be included in the submittal.
- e) Adequate ventilation is to be provided by means of vermin and dust proof louvers.

2.4.2 SUPPORTS

Each distribution feeder pillar shall be attached to the transformer by a suitably designed and approved busbar trunking with duct/flange. The neutral connection shall be insulated from the frame and brought out to a separate terminal. The weight of the feeder pillar shall be carried on its own support and not on the busbar trunking.

2.4.3 CABLES, GLANDS AND LUGS

- a) All cable glands and lugs shall be suitable for termination of armoured 240mm² 4-core copper cable using brass compression type glands. Cross sectional details of the cable will be supplied to the successful contractor.
- b) The earth tag of each gland shall be connected to the earth bar with tinned copper flexible earthing braid of adequate cross section having at least 50% of that of the phase conductor of the cable to be connected. Each cable gland shall be supported on a removable gland plate. The glanding arrangement shall fully ensure earth continuity through the cable armour.
- c) Cable clamps shall be provided at the bottom of the feeder pillar to hold the cables in position.
- d) All the cable lugs for copper cable shall be tinned copper compression type.

2.4.4 USE WAYS AND FUSES

- a) The use ways shall be 3No. single-pole switchable load-break strip fuse-ways 630A Size 3 rating to IEC 60269-4.
- b) All fuses shall be NH low-loss type Grade 3 as per IEC 60269-4. All fuses shall be 400A rated. Only VDE marked or ASTA certified fuse links are acceptable. The operating time/current characteristics shall be supplied with the offer.
- c) A blank circuit label to be provided on each unit. Each Strip Fuse unit shall have 3 robust transparent hinged covers to retain the fuse firmly and for single pole switching operation. The cover shall be latched in the closed position to prevent it from falling out when the fuse is not fitted. Preferably, each cover shall have a neon indicator showing a blown fuse (but not the absence of a fuse).
- d) The Unit shall have high-making capacity. Closing on the fault shall be safe for both the Operator and the equipment. In addition, the strip fuse ways shall have insulating base, fuse carrier, insulating caps and terminals covers insulating protectors in the fuse links to avoid accidental contacts.

2.5 DETAILS OF EQUIPMENT

2.5.1 BUSBARS

The busbars shall be hard-drawn, high-conductivity, tinned copper and rigidly supported. They shall be positioned to give maximum access and be colour coded for identification by shrinkable insulating tube.

ADSSC/GSEW	Division 16	Section 16160	Package Type Unit Substation	Rev: 01	April 2008	Page 14 of 20
------------	-------------	---------------	------------------------------	---------	------------	---------------

2.5.2 INCOMING UNIT

One incoming unit with hook-operated slow-make and break-off load-hinged isolating switch blade on each phase for control of the transformer. Switch blades shall be fitted with contact tightening clamps. It shall be possible to leave the incoming isolators open 'LIVE' with the door closed. On each phase, a current transformer shall be provided for operation of instrumentation.

2.5.3 AMMETERS

Three single-phase ammeters, with instantaneous elements plus maximum current demand indicators of the thermal type, shall be supplied. They shall be suitable for operation from the current transformers specified.

2.5.4 VOLTMETER

- a) One Voltmeter 0-500V with phase selector switch shall be supplied.
- b) The maximum demand indicator voltmeters and selector switch shall be mounted on an instrument panel. In addition, three potential test terminals shall be included and mounted on the panel.

2.5.5 EARTH BAR

- a) An earth bar, not less than 50mm x 10mm, shall be provided at the bottom and secured to give a positive electrical connection. In addition, two 12mm earth terminals shall be provided on the pillar shell and connected to the earth bar.
- b) A detachable link between neutral and earth bar shall also be provided.

2.5.6 WIRING

Wiring shall be minimum 2.5mm² stranded copper conductor, 600V tropical grade heat-resistant PVC-insulated.

2.5.7 BASE PLATE

The Base Plate of the feeder pillar shall be supplied with knockout holes. The gland plate of the feeder pillar shall be so positioned to allow a convenient bend radius on the outgoing cable(s).

2.5.8 NUTS AND BOLTS

All necessary nuts and bolts for cable lugs, spacers, etc., shall be supplied fitted with the feeder pillar.

2.5.9 RATINGS

The feeder pillar rating for different package units shall be as follows:

Particulars	2000kVA	1500kVA	1000kVA	500kVA	200kVA
Phase and Neutral Rating	3,200A	2,500A	1,600A	800A	400A
Minimum Bus Bar Size	2,000mm ²	1,600mm ²	1,000mm ²	500mm ²	300mm ²
Number of Outgoing Unit Strip (Fuse Way)	9	9	8	6	3
Provision for further additional Strip Fuse Way	1	1	1	1	1

2.6 PACKAGE UNIT HOUSING

2.6.1 METALLIC HOUSING

- The Housing shall be made of ALUZINC steel sheets having a thickness not less than 2mm corrosion proof. The base frame shall be made of hot dip galvanised steel sheets of minimum thickness 4mm and the four corner columns/posts shall be made of hot dip galvanised steel sheets of minimum thickness 3mm.
- The transformer, low voltage and MV compartments are completely separated by ALUZINC steel sheets. The steel provides strength while the aluminium and zinc alloy coating provides protection against corrosion due to harsh environment condition.
- The metallic housing shall be of adequate strength to withstand transportation and handling stresses. The weight of the unit will be an important consideration. A detailed painting system and dimensional drawing shall be submitted with tender.
- The metallic ceiling shall be of a double roof system as a provision to diminish heating due to solar radiation. The opening at the lower and upper sides of the roof allows air circulation.
- The degree of protection at the transformer compartment shall not be IP23 while the degree of protection at the LV and MV compartments shall not be less than IP43.

2.6.2 FLOOR AND ROOF

The roof shall have a lightweight design with lifting hooks for easy removal of the roof during transformer removal or any major part of the unit. The

metallic ceiling of the substation shall be of a double roofing system to diminish heating due to solar radiation.

2.6.3 WALLS

The housing shall be made of ALUZINC steel sheets having a thickness not less than 2mm corrosion proof. The basic frame of the kiosk shall be made of galvanised steel structure, on which the housing is fixed. The steel four corner posts of the substation shall enhance the strength of the whole assembly.

2.6.4 DOORS

- a) Double-leaf doors shall be made of ALUZINC steel sheet, framed and panelled type. They shall be fixed on opposite sides of the package unit (LV & MV Compartments), and on both sides of the transformer compartment.
- b) The doors shall be provided with stainless steel/brass hinges and provided with internal stoppers to limit the opening to 120°. The edges of the doors shall be bent on both sides to assure they fit properly to the door jambs to prevent misalignment. All doors' gaskets shall be of superior quality and capable of withstanding the severe climatic conditions.
- c) Doors shall be fitted with a central handle with a 3-point cam. The handle shall be fitted with a cylindrical lock. The cam assembly with lever shall be made of non-corroding metal.
- d) The cylindrical lock shall be suitable for master key no. AWG V/1, made by Messrs. Josiah Parkers and Sons, Union Works, Gower Street, Willen Hall West Midlands WV13, U.K., England. Alternatively, lock of a make with the same specification and suitable for master key already in use with ADDC is acceptable.

2.6.5 CABLE ENTRIES

The substation shall be designed to receive cables entering horizontally below ground level. Adequate provision shall be made to seal the cable entries against ingress of water.

2.7 INSPECTION AND TESTS

The equipment shall be subject to inspection and testing during manufacture and after completion by ADSSC in accordance with Section 15001: General M&E Requirements. In addition, the following shall be carried out:

ADSSC/GSEW	Division 16	Section 16160	Package Type Unit Substation	Rev: 01	April 2008	Page 17 of 20
------------	-------------	---------------	------------------------------	---------	------------	---------------

2.7.1 HV SWITCHGEAR

a) Type Tests

- i. Dielectric Tests.
- ii. Temperature Rise Tests.
- iii. Making and Breaking Tests.
- iv. Rated Peak Withstand Current and Rated Short Time Current Tests.
- v. Operation & Mechanical Endurance Tests.

b) Routine Tests

- i. Power Frequency Voltage Tests.
- ii. Voltage Test on Auxiliary Circuits.
- iii. Measurement of Resistance of main Circuits.
- iv. Operation Tests.

2.7.2 TRANSFORMER

Testing of transformers shall be in accordance with Section 16150: Power Distribution Transformers.

2.7.3 LV SWITCHGEAR

a) Type Tests

- i. Dielectric Tests.
- ii. Rated Making and Breaking Capacity Tests.
- iii. Rated Fused Short Circuit Current Tests.
- iv. Mechanical Endurance Tests.
- v. Electrical Endurance Tests.
- vi. Temperature Rise Test. (Details of Testing Procedure to be submitted.)

b) Routine Tests:

- i. Operation Tests.
- ii. Dielectric Test.

2.7.4 COMPLETE PACKAGE SUBSTATION

a) Type Tests

All the type tests shall be made on a complete package substation:

- i. Insulation level on the package substation.
- ii. Temperature rise (Heat and Run Test)
- iii. Earthing circuits withstand to rated peak and short time currents.
- iv. Functional Tests.
- v. Degree of protection.

- vi. Enclosure withstand against mechanical stresses.

(b) ROUTINE TESTS

Routine tests shall be made on each complete package substation:

- i. Voltage Test on Auxiliary Circuits.
- ii. Functional Test
- iii. Verification of correct wiring

NOTE:

Verification of the Type Tests is not required if already performed earlier on similar unit. In such case, Type Test Certificates shall be included in the submittal.

2.8 DOCUMENTATION AND ENGINEERING DATA

The Contractor shall submit all technical descriptions, data sheets, catalogues and other supporting material with the offer to enable ADSSC to fully evaluate the proposal with regards to its compliance with the contract specifications and Section 15001: General M&E Requirements.

The following shall be submitted as a minimum:

- a) All technical schedules, duly filled-in and signed.
- b) Copies of Type Test Certificates for 11kV Switchgear, Transformers etc.
- c) Proof of Manufacturer's compliance with the requirement of ISO 9000 and its relevant parts or its approved equivalent National Standard as Certified by an Independent Inspection Agency.
- d) All the drawings, technical information, calculations and other supporting documents.
- e) For the RMU:
 - i. General arrangement of the unit showing all important dimensions, together with mountings/accessories.
 - ii. Details of HV Cable Terminations.
 - iii. Details of Fault Current Indicator.
 - iv. Operation and tripping characteristics of the Transformer Control Unit.
 - v. Details of Painting and Anti Corrosion Protection for exterior of the unit.
- f) For the Distribution Transformer:
 - i. Documentation shall be in accordance with Section 16150: Power Distribution Transformers.

- g) For Duct Type/Flange Connected Feeder Pillar
 - i. Details of Strip Fuse Way.
 - ii. Characteristics of HRC Fuses.
 - iii. Drawing Showing the Internal Arrangement of Feeder Pillar.
- h) For Duct Type/Flange Connected Feeder Pillar
 - i. Construction details of the Housing.
- i) For Duct Type/Flange Connected Feeder Pillar
 - i. Details Summary of Deviations from the Contract Specification.
 - ii. Brochures and Catalogues for Standard Unit.
 - iii. Applicable Design Specification.
 - iv. Lists of Accessories included.

END OF SECTION