ELECTRICITY MANAGEMENT SERVICES LIMITED

4, Dar Es Salem Crescent, Off Aminu Kano Crescent, Wuse II, Abuja, FCT

INSPECTION REPORT OF ONITSHA – ASABA 330KV TRANSMISSION LINE, ASABA 330/132/33 KV SUBSTATION AND ASABA 132/33 KV SUBSTATION

NDPHC letter No NIPP/TRX/2119 dated 9th February, 2015 on the above subject matter refers, please. The Inspection/Test of Onitsha – Asaba 330KV (SC) OHTL with the associated Asaba 330/132/33KV substation and Asaba 132/33 KV substation was carried out between 11th and 14th February, 2015. The following persons were present for the exercise;

a. Electricity Management Services Limited (EMSL) Officials:

i.	Engr. Tukur Gidado	ED (TS)
ii.	Engr. T.T Aliyu	Head (TS & IS)
iii.	Engr. Richard Nwaneri	AIE – Enugu Inspectorate Field Office
iv.	Engr. Jimoh Alaba Quadry	AIE – Benin Inspectorate Field Office
v.	Mr Usunabor Friday	Works Superintendent – Benin Inspectorate Field Office

b. Client Officials:

i.	Engr. Godfrey Duru	Project Manager (T3)
ii.	Engr. C.A. Ogunrinde	DGM Civil Field Operations

iii. Consultant (Intec Limited):

i.	Engr. Bayo Benson	Intec Representative

iv. TCN Officials:

i.	Engr. I.M Mbah	Project Manager (Lines)
ii.	Engr. Josephine N. Mada	Project Engineer (Lines)
iii.	Mr Emma Onyekanma	Head Operator (Systems Operations)

v. Contractor (AK-AY Elektrik Ltd, Dextron Engineering Ltd. and PIVOT Ltd.) Officials:

i.	Engr. Odinaka Amobi	Project Manager
ii.	Ferda Gayir	Primary Team Leader
iii.	Engr. Isaac A. Agunbiade	Project Manager

2. Project Details and Objective

2.1. Contract Details

Client	NDPHC
Consultant	Intec Limited
Contractors	AK-AY Elektrik Ltd, Dextron Engineering Ltd and PIVOT Ltd.

2.2. Project Description

2.2.1. Onitsha – Asaba 330KV SC OHTL

Total length	18. 62 KM
No of Circuit	One (1)

No of Conductor per Phase	Two (2)
No of Spacers per Phase/Span	7/8
No of Dampers per Phase/Span	2
Conductor Type	ACSR
Conductor Size	463mm^2, 826mm^2 at river crossing
Phase Configuration	Horizontal
Earth Wire Type	Copper (Substation); Galvanized Steel (Earth Shielding System)
OPGW	Galvanized Steel with embedded Optic Fibres
Type of Support	Lattice Galvanized Steel Towers
Type of Foundation	Grillage/Concrete Pad & Chimney
Rated Voltage	330KV
Insulator Type	Composite, Disc Insulators (Glass) at the Substation
No of Insulators per Phase	18/19 at the substation

2.2.2. Asaba 330/132/33 KV Substation

i. 330KV interconnecting bays with associated protection (V.Ts, C.Ts, Line Isolator, Breaker, etc.) Schemes for the incoming Onitsha 330KV SC OHTL, outgoing Benin 330KV SC OHTL, 132KV interconnecting bays, with their associated protection schemes
ii. 1 x 150 MVA, 330/132/33KV Power T/F
iii. 1 x 300 KVA, 34.5/0.415KV Earthing/Auxillary T/F
iv. Control Room with Control & protection Equipment Therein

2.2.3. Asaba 132/33KV Substation

i. 132KV interconnecting bays with associated protection equipment
ii. 2 x 60 MVA, 132/33KV Power T/Fs
iii. 2 x 300 KVA, 34.5/0.415KV Earthing/Auxillary T/Fs
iv. Control Room with Control & protection Equipment Therein

2.3. Project Objective

The objective of this project is to link and/or interconnect Asaba, Delta State with 330KV National Grid System, with the long term purpose of making it a hub, due its strategic location.

2.4. Summary of Observations & Recommendation

2.4.1 Onitsha – Asaba 330KV SC OHTL Project

Onitsha – Asaba 330 KV SC OHTL is a component of the Onitsha – Benin 330 KV SC OHTL that was fast tracked to enable the required Turn-In-Turn-Out at Asaba 1 x 150 MVA, 330/132/33 KV substation.

S/NO.	PROJECT AREA	OBSERVATION	PICTORIAL ILLUSTRATIONS	RECOMMENDATIONS
1.	Tower structures and Foundations	The 330KV SC Onitsha – Asaba OHTL was seen supported on towers made of galvanized steel lattice structure. Each of the tower legs was firmly erected on rectangular concrete foundation (bases). Anti-vandals (specially made) bolts and nuts were used for fixing the tower members to prevent easy removal by vandals. Also the step bolts used for the erection of the tower were still in position at the time of our inspection visit		i. In order to prevent easy climbing access by vandals, all the step bolts below the anti-climbing devices should be removed from position as advised ii. All tower location within visible erosion prone areas along the entire

		The following were also observed; i. The towers at River Niger crossing and swampy areas, were erected on pile foundations. ii. The tower legs bucket of the river crossing towers have the tendency of retaining water when the holes provided for draining trapped water are blocked by debris. iii. No tower was erected within the River Niger channel. However, the two towers used for crossing the river are of 187 metres high, which is adequate for the line clearance to the river during high tides. iv. Four types of designs were employed for the towers between Onitsha – Asaba substation (Dextron Towers, Special River Crossing Towers, KAC Towers and the existing Towers).	 	transmission route length, should be provided with erosion control measures iii. The TCN maintenance crew should be adequately informed on the possibility of water retention at the tower legs bucket of the river crossing towers, to ensure that the drainage holes are free of debris.
2.	Materials of line conductors, Earth conductors and other	The materials employed for the line conductors are aluminum conductor steel re-enforced (ACSR) of code name “Bisson” having a cross-sectional area of 463mm^2 each		i. The connection of the earth conductors to the some of the tower legs should be done

fittings	of the double conductors and 826mm^2 for the single conductor provided for the river crossing. The earth conductor for the towers were of galvanized steel type. The following were also observed; i. The Earth conductor connection to the tower legs were done using clamps at some towers. This may not give the necessary/proper contacts. ii. The red and blue phases of the OHTL were interchanged (transposed) along the line at Agbor Village in order to have the correct phase sequence at entry point of the Asaba 330/132/33KV substation	 	via the appropriate cable locks. ii. The contractor should ensure that adequate clearance is achieved at the red and blue phases interchange around the line at Agbor Village near the river bank.

3.	Anti-climbing Devices, Danger notices/Plates, Anti-vandals etc.	Anti-climbing devices, danger plates and number plates have not been provided/fitted on all the towers from Onitsha to Asaba. Also, Aerial identification plates were not provided on the towers. However, it was noticed that the phase identification plate has been fitted on the tower within the Asaba substation. Other observations are; i. Considering the existence of low flying aircrafts, aerial marker balls were provided on the transmission lines at river crossings only. ii.	 	i. Anti-climbing devices, danger plates, number plates and aerial number plates should be provided and fitted on all the towers from Onitsha – Asaba. ii. Phase identification plates should be fitted on all towers.

4.	OHTL Stabilization Facilities	From thorough inspections and checks, insulators, spacers, vibration dampers and corona rings were provided and properly erected except we noticed that arcing horns are missing on most towers.		Arching horns should be installed.
5.	330KV OHTL Status	The tensioning of the 330KV OHTL was observed uniformly executed and the towers properly aligned. Tests were carried out on the OHTL to ensure continuity and clearances. See Appendix IV		Ensure that the tower legs of the towers within the swampy areas are further protected by bitumen coating up to a certain height above the chimneys.
6.	Line Trace and Access Road	The terrain traversed by the 330KV SC OHTL is a difficult one with heavy vegetation and swampy areas. At the time of our inspection visit, there was provision for		The line trace should be properly and adequately maintained and secured.

motorable access earth road along the OHTL route. The contractor ensured the access road route did not pass directly under the towers to prevent possible drive through by motorists. In some cases, the tower bases were fenced to avoid direct access to motorist.

The swampy areas were however not provided with motorable access road.

The fence around the towers should be effectively earthed.

7.	330KV OHTL Crossings	Observations also revealed that there were no railway lines crossings along the trace of the 330KV SC OHTL. However, the line crosses River Niger, existing 33KV, 11KV and 0.415KV OH lines at many locations, as well as some major roads. At all these crossings, statutory safety clearances were maintained throughout the lines route. Other observations are; i. The 330KV OHTL passes over a building within Ranco Manufacturing Co Ltd. Onitsha, with a clearance of about 5.7 metres.	 	i. All existing structures within the right of way of the transmission line should be demolished. ii. The contractor should liaise with the respective distribution companies to ensure that all channel irons of the 33/11KV lines at the crossings of the 330KV OHTL are appropriately earthed.
8.	Earthing System/Earth Tests Carried out	Two methods of earthing system in addition to the grounding sky wire were adopted. Namely; - Counterpoise earthing		The contractor should carry out further earthing improvements for all earthing resistance above 10 Ω

- Individual tower legs earthing

In both cases, physical earth connection to the tower legs was seen and visible. The results of the random earth resistance measurement tests for the tower legs were as recorded in appendix I & II

2.4.2 Asaba 1 x 150 MVA, 330/132/33KV Substation

Asaba 1 x 150 MVA, 330/132/33 KV substation was executed by Ak-Ay Elektrik Co Ltd.

1.	Asaba 1 x 150 MVA, 330/132/33KV Substation	Ak-Ay Elektrik Co Ltd. Pre-commissioning engineers have proved the integrity of the Asaba 1 x 150 MVA, 330/132/33KV substation by executing and demonstrating the following functional tests in our presence (EMSL engineers) where practicable; i. Remote/manual and automatic operations of all isolators and circuit breakers ii. Alarms response to failures of various components of the protection equipment such as breaker trip coil failure, loss of SF6, motor and heating MCB failure, etc. were demonstrated iii. Relay injection simulation test to verify differential,	 	i. The alarms response to actuated failures of some of the components of the protection equipment did not respond. We recommend that the contractor should ensure that the system is properly adjusted for appropriate alarm responses to failures of sensitive components of the protective equipment. ii. The provision of a spare transformer in

overcurrent and earth fault protection schemes were not demonstrated

iv. Tripping of circuit breakers in response to actuation of Buccholz relay and transformer pressure release valves were not demonstrated

Further observations within the substation and control room revealed the following;

i. The switchyard equipment (CT, VT, CVT etc.) and gantries are of high quality and well laid.

ii. At the time of our inspection visit, covering of cable trenches/ducts were still on-going.

iii. The fence of the active area of the substation is yet to be erected.

this very important substation cannot be overemphasized. Therefore, the available 1 x 150 MVA, 330/132/33 KV transformer already at the site should be installed.

	However, the gravelling of the substation has been completed.		iii. The erection of the active area fence should be completed and earthed.
iv.	No insulation rubber mats provided for all the panels in the control room		iv. Contractor to provide insulated rubber mats on all control panel floors
v.	The contractor did not demonstrate the operation of the changeover switch/interlock between the station's 415V supply and the standby generator supply		v. Generator, main supply, changeover/ interlock operation should be demonstrated prior to handing over the substation
vi.	There were no indications for the 1 x 150 MVA transformer oil and winding temperatures on the control panel. Also, the indicators supplied were not compatible with the panels; however, the contractor assured that the indicating		vi. Appropriate means of monitoring transformer windings temperatures should be installed in the

	meters have been ordered and is awaiting delivery.			control room
vii.	The control panel labels were not adequately labelled.		vii.	The labelling in the control room should be consistent and explicit
			viii.	Disc insulator strings of 20/21 nos and 10/11 nos should be employed for 330 KV and 132 KV side of the substation respectively.
viii.	The 18/19 nos and 8/9 nos of disc insulators per string used at the 330 KV and 132 KV side of the substation respectively are not adequate for the necessary clearance between the gantries and the lines.			
			ix.	The subcontractor for the installation of the communication panels should be directed to complete his installations to enable smooth operation of the substations
ix.	Although all the substation web traps have been installed, the communication panels are yet to be installed.			
x.	The installation of the security lights have not been completed.		x.	The remaining street lights should be

	xi. The CCTV cameras have been installed for the entire switchyard instead of the thermal cameras recommended in the RFP		erected. xi. The open cable trenches should be covered with concrete slabs of adequate bearing strength xii. Thermal cameras that indicate hot spots within the switchyard during operations should be installed in addition to the CCTV cameras.
	xii. The firefighting equipment/devices provided for the substations are not adequate.		xiii. The contractor should provide adequate firefighting equipment/devices to be placed at strategic locations within the substation yard/control rooms

2.4.3 Asaba 2 x 60 MVA, 132/33KV Substation

Asaba 2 x 60 MVA, 132/33 KV substation is being executed by PIVOT Engineering Ltd.

1.	Asaba 2 X 60 MVA 132/33KV Substation	At the time of our inspection visit, the 2 x 60 MVA, 132/33KV substations was under construction. The necessary inspections of the substation was therefore not carried out		The contractor should expedite the construction of the substation and EMSL informed for inspection/testing and certification of the project before commissioning.

2.4.4 General Observations

1.	General Observations	i.	The Asaba – Benin axis of the 330 KV SC OHTL was under construction at the time of our inspection visit.		i.	To enable the continuation of the construction of the 330 KV SC OHTL along Asaba – Benin axis, adequate isolation of the line should be carried out at the Asaba substation and the nearest sectional tower to ensure safety of personnel during the construction.
		ii.	The metal doors of the control rooms are not earthed			
		iii.	No eye wash basin had been installed in the battery room at the time of our visit.			
		iv.	During the introduction meeting before the commencement of our inspection exercise, the NIPP project manager informed the meeting that out of the 50 Km Asaba – Benin 330 KV SC OHTL, 31.7 Km had been completed. The highlights of the meeting is attached as appendix III		ii.	The frames of all metal doors of the control room should be earthed
					iii.	The eye wash hand basin should be safely positioned and installed in the

	battery room, to make it readily available in an emergency.

Conclusion

Please note that the re-inspection and certification of the project will be carried out on your compliance with the action points/recommendations of this report and the necessary payment of Inspection and Re-inspection fees in the sum of **One Million, Six Hundred and Thirty Eight Thousand Naira (₦ 1,638,000.00) only.**

Signed by:

INSPECTING/TESTING AUTHORITY: ELECTRICITY MANAGEMENT SERVICES LIMITED ---------- Date----------

APPENDIX I

ASABA - ONITSHA OHTL TOWER LEGS EARTH RESISTANCE READINGS IN OHMS

TOWER NUMBER	Ohms (Ω)	Ohms (Ω)
T243	**0.5**	**0.56**
T249	**0.61**	
T250	**0.06**	**1.06**
T254	**1.20**	**0.90**
T258	**0.06**	**0.05**
T267	**2.10**	**0.10**
Crossing Tower River Niger, Asaba Side	**0.06**	**0.14**
Crossing Tower River Niger, Onitsha Side	**0.09**	
T275	**0.5**	**1.3**
Old Tower	**9.1**	**11.9**
T287	**6.44**	**6.49**

REMARKS: Contractor should please take steps to improve the earthing on those towers with earth resistance readings that are above 10Ω.

APPENDIX II

EARTH RESISTANCE READINGS [OHMS Ω] IN ASABA SUBSTATION

ITEM /AREA DESCRIPTION	EARTH LEAD
D04 – T51	0.10
D04 – Q81	0.10
BusBar 1	0.06
D05 – Q11	0.10
D04 – T11	0.15
D04– Q01	0.15
D04 – T12	0.15
D05 – Q03	0.10

ITEM /AREA DESCRIPTION	EARTH LEAD
D04 – Q82	0.15
D04 – Q92	0.15
D05 – Q82	0.16

APPENDIX III

Onitsha – Asaba 330/132 KV Line Site Meeting

Date: 12th February, 2015

Location: Onitsha – Asaba 330/132 KV Switchyard Control Room

ATTENDANCE

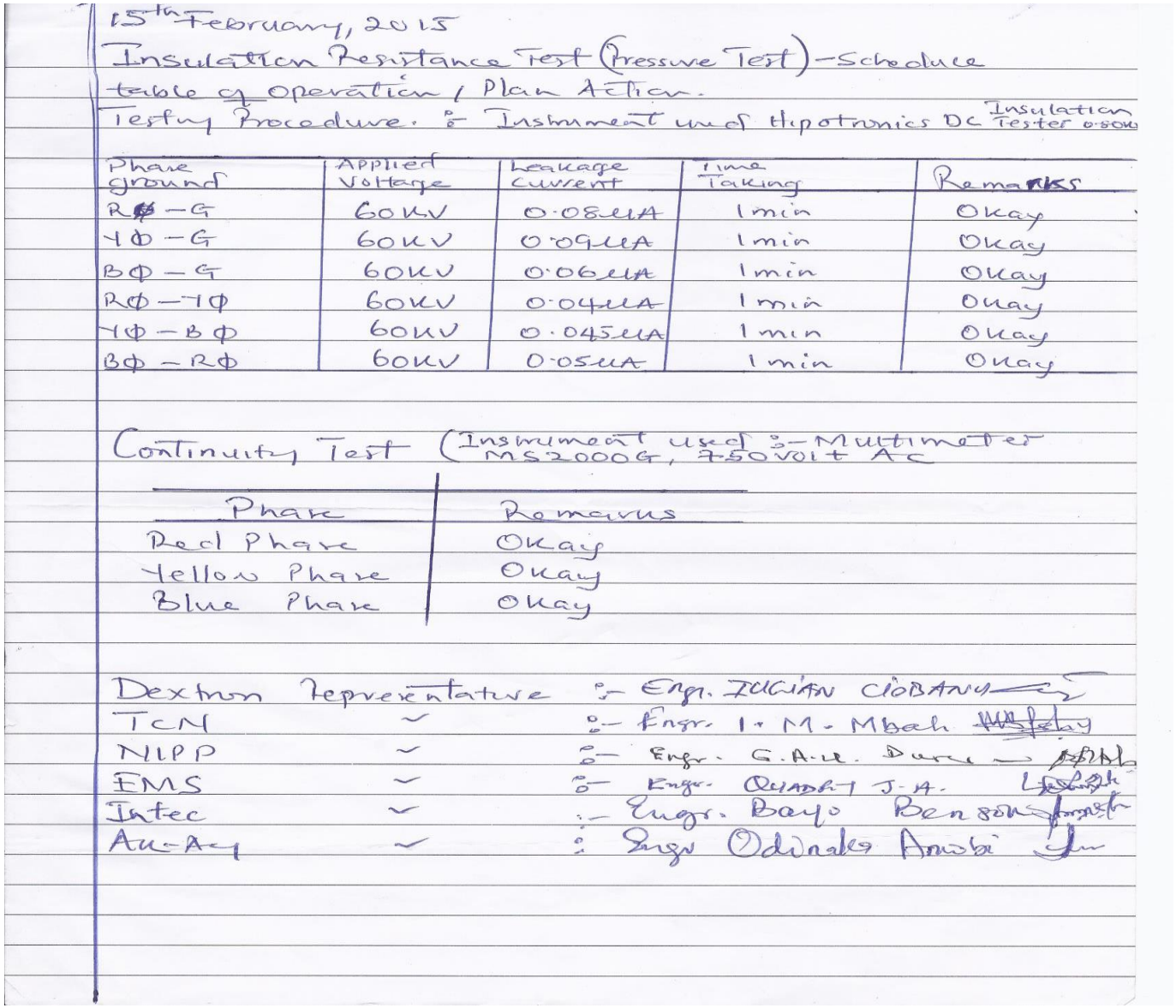
S/NO.	NAME	ORGANISATION	DESIGNATION	E-MAIL ADDRESS	TELEPHONE
1	Engr Godfrey Duru	NDPHC - NIPP	Project Manager (Team 3)	numekeng@yahoo.com	08037045369
2	Engr Tukur Gidado	EMSL	ED (TS)	engrgidado@yahoo.com	08034518055
3	Engr Aliyu Tukur	EMSL	H (TS & IS)	aliyutukur67@yahoo.com	08033493741
4	Engr Quadry Alaba	EMSL	AIE - Benin	halabarma@yahoo.com	08033519956
5	Engr R.O. Nwaneri	EMSL	AIE - Enugu	nwerichard@gmail.com	08067194150
6	Mr Usunabor Friday	EMSL	Works Superintendent - Benin	_	08055161399
7	Engr I.M. Mbah	TCN	Project Manager (Lines)	mbh_mbah@yahoo.com	08050511517
8	Engr Josephine N. Mada	TCN	Project Engineer (Lines)	jossyony@yahoo.com	08051480157
9	Mr Emma Onyekanma	TCN - SO	Head Operator	immaonyes@yahoo.com	08038713177
10	Engr Isaac A. Agunbiade	PIVOT	Project Manager	isaac_agunbiade@pivot-engineering.com	08035319604
11	Engr Bayo Benson	INTEC	Project Engineer	bayo.benson@gmail.com	08033144999
12	Engr Odinaka Amobi	AK - AY	Project Manager	odyamobi@yahoo.com	08035771249
13	Ferda Gayir	AK - AY	Primary Team Leader	fedargayir@ak-ay.com	08039345408

HIGHLIGHTS OF THE MEETING

1. The ED (TS) EMSL briefed the meeting by laying emphasis on the need for Inspection, testing and certification which helps in ensuring safety of lives & property, reliable power supply and standardized electrical installations in NESI.
2. The contractor followed suit by briefing the team on the project.
3. Head (TS & IS) EMSL, further reiterated the need for inspection, testing and certification of projects by eliciting the role of EMSL in relation to this.
4. NIPP came thereafter to shed light on the project's historical background – They touched on the strategic location of the s/s and how they envisaged it as a hub for the transmission network.
5. The Client/project owners were asked to note that it was of paramount importance to complete all necessary remedial works along the Onitsha – Asaba 330kV SC OHTL and also within the switchyard to ensure a healthy installation with proven integrity.
6. While thanking the team for a Job well done, the contractor promised to look at all observations raised with a view to carrying out the recommendations therein.

APPENDIX IV

Onitsha – Asaba 330KV SC OHTL Pressure Test Results



15th February, 2015

Insulation Resistance Test (Pressure Test) – Schedule table of Operation / Plan Action.

Testing Procedure :- Instrument used Hipotronics DC Insulation Tester 0-60kV

Phase ground	Applied Voltage	Leakage Current	Time Taking	Remarks
RΦ – G	60KV	0·08mA	1min	Okay
YΦ – G	60KV	0·09mA	1min	Okay
BΦ – G	60KV	0·06mA	1min	Okay
RΦ – YΦ	60KV	0·04mA	1min	Okay
YΦ – BΦ	60KV	0·045mA	1min	Okay
BΦ – RΦ	60KV	0·05mA	1min	Okay

Continuity Test (Instrument used :- Multimeter MS2000G, 750Volt AC

Phase	Remarks
Red Phase	Okay
Yellow Phase	Okay
Blue Phase	Okay

Dextron Representative :- Engr. ZUCIAN CIOBANU

TCN ~ :- Engr. I. M. Mbah

NIPP ~ :- Engr. G.A.U. Duru

EMS ~ :- Engr. Quadri J.A.

Intec ~ :- Engr. Bayo Benson

AK-AY ~ : Engr Odinaka Anosi