

GENERAL TECHNICAL SPECIFICATIONS

**CONSTRUCTION OF NEW MEDIA CENTRE & WELLNESS CENTRE AT EKURHULENI EAST
TVET COLLEGE**

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GENERAL TECHNICAL SPECIFICATION

The purpose of this document is to state all the technical requirements regarding quality and standard of work and materials to be procured, delivered, installed and commissioned, and contains inter alia the specifications of certain equipment that is to be procured by the contractor in terms of the tender and attached bill of quantities. It is therefore divided in different headings as follows.

1 GENERAL REQUIREMENTS

All work should be done and all materials supplied should be in accordance with the applicable standards and good practice, and more specific all electrical work in accordance with SANS 10142-1, the standards referenced there-in, and along the requirements of the local electrical supplier, the client and the specifications following. Tenderers are reminded that more specifically the following Acts, Bylaws, Regulations and standards are to be adhered to:

SANS 10142-1 as mentioned above, and where applicable, SANS 10142-2;

SANS 10114-1 & SANS 10114-2 where applicable;

SANS 10313 where applicable;

All the standards as referenced in the specification below;

Occupational Health and Safety Act, Act 85 of 1993, as updated, and all applicable Regulations enacted in terms of this Act, whereof the following are more specifically mentioned:

General Machinery Regulations;

General Safety Regulations;

Electrical Machinery Regulations; and

Electrical Installation Regulations;

Any provincial local Electrical Bylaws, Fire Regulations/Bylaws, and other provincial or local bylaws and regulations that may be applicable;

SANS 10400 – the National Building Regulations; and

SANS 204 regarding energy consumption and savings.

Tenderers are advised to visit the site and acquaint themselves with relevant local conditions that may have an impact on the work in any sense before they submit the tender. Storage of materials will only be done in areas allocated by the principle contractor on site. Securing any stored materials will be the responsibility of the successful tenderer. No claims regarding local conditions, theft of or damage to materials can be entertained after appointment of the successful tenderer.

The tenderer shall comply and adhere to any local or national requirements such as notices, fees payable, labour requirements, warning signs, equipment, commissioning and/or tests and include the cost thereof either in the appropriate slot in the bill of quantities, or in the P&G's.

The tenderer shall note that up to 5% retention of amounts payable to the successful tenderer may be held back by either the principle contractor or the quantity surveyor.

2 MATERAIL SPECIFICATION

All materials to be supplied in terms of the tender are required to comply with the following specifications:

A. 11kV panels

11kV panels to be installed in a typical substation building are being specified by the engineer as per the particular requirements of the project, and he will get a quote on which the contractor has to order the specified equipment. The contractor has to be present at the factory test, and once delivered, place and connect the steel clad panels. Generally, the panels have to comply with the requirements and standards of SANS 1885 / 62271 and all the standards mentioned there-in, local supplier requirements, and are to be supplied with the following properties included:

Protection:	Overcurrent, Earth fault and where required Differential protection;
Insulation medium:	Vacuum or SF6, as specified
Busbar current rating:	800A, or as specified

Remote:	Provision for remote switching complete with remote and cable or by remote panel, as specified
Local/Remote switch:	Required
Cable alive indication:	Red light = on, Green light = off
Cable entry:	Bottom, or as specified
Panel meters:	Voltage, and all three phase currents

All indicator lighting shall have a mean time between failure rating of at least 25 000h, to be guaranteed by the supplier

B. Ring Main Units

Medium Voltage Ring Main Units typically consists typically of two medium voltage isolators and one switch controlled by a protection unit. The unit should in all aspects comply to the requirements of SANS 1874 and the standards referenced there-in, and if used outside the kiosk should comply to the requirements of SANS 62271-202. It should further comply to the following requirements:

Insulation medium:	Vacuum or SF6
Busbar current capability:	At least 630A
Isolator current capability:	At least 630A
Switch current capability:	At least 200A, or as specified
Protection unit:	VIP400, Micom P123 or similar overload and earth fault protection unit
Kiosk:	To be supplied with arc vent complying to SANS 62271-202 Annex A Clause A.2.3

If of the metered type the following should be complied with:

Class 0,5 10VA metering CT's 400/200/5 or as specified
Elster Kent 1700 meter with remote sending capabilities
Class 1 100VA 11000/110V VT

The lightning impulse withstand rating shall be at least 75kV. The cable compartment shall make provision for medium voltage cables of sizes 70 - 240mm², and should be constructed in such a way that the cable is not supported by the electrical terminals.

All indicator lighting shall have a mean time between failure rating of at least 25 000h, to be guaranteed by the supplier

C. Minisubs

Minisubs should be Type B and fully comply to the requirements of SANS 1029 and any standards referenced there-in. It consists mainly of three compartments and the MV switchgear should comply to SANS 1874, SANS 602271-200 and -202, the transformer to SANS 780, whereas the low voltage compartment circuit breakers should comply to SANS 1973, SANS 556, SANS 60947-3, SANS 60149-1 and all and any standards as referenced therein.

Minisubs normally transform either 22, 11 or 6,6kV to 400/230V in different capacities, whereof the following are standardised sizes: 200, 315, 500, 630, 800, 1000 and 1250kVA. Dual voltage minisubs may also be specified. Note the detail as mentioned in the bill of quantities.

The minisubs shall be suitable for operation at the location as specified in the tender. Specific requirement is that the minisub at the specified location should be able to handle its rated load +10% continuously for a period no longer than 2 hours irrespective of environmental conditions without any damage to any component inside the minisub. Specific attention is called to the fact that as most LV equipment is rated for temperatures no higher than 70°C the LV compartment should never exceed this temperature, even whilst the transformer may be reaching its specified maximum of 100°C. Cooling (whether natural or forced) of the transformer and LV compartment should be sufficient to ensure compliance to the above.

Furthermore, as minisubs may be placed in areas accessible to the public, no external part including the radiator fins shall exceed at any time the temperature as stated in SANS 10142-1 Clause 5.1.2.1(a), namely 70°C, to protect the public against burning and /or damage.

The doors as supplied must enable access to all maintainable or connectable parts. In accordance with SANS 10142-1 Clause 5.1.1 any live parts should be hidden behind panels only removable with a tool.

All doors shall be locked with a three point locking mechanism, with the physical padlock behind a cover with should make it almost impossible to cut the padlock with a bolt cutter, at the same time enabling easy placing and removal of the padlock.

The minisub shall be supplied with suitable lifting hooks capable of carrying the weight they have to carry with a safety factor of at least 1,6.

Minisubs shall be delivered complete with a suitable concrete plinth and should be sufficiently protected against any environmental pollution which may occur at the specified location. Only coastal type minisubs to be used within 50km from the coast, for example.

The tendered rate shall include design, manufacturing, factory inspection and -inspection tests, operation and maintenance manuals, and delivery to site - which may be a separate item on the quote / invoice. Test results are to be made available to the engineer and any testing to be communicated at least 3 working days before the tests are commenced.

The ring main unit generally shall comply to the specifications above, except that the busbar rating may be reduced to 400A, and so the isolators. The circuit breaker may be rated for only 100A. Transformer protection on the circuit breaker is advised but not a requirement.

The transformer shall be of the hermetically sealed tank type, with sufficient space above the transformer oil to allow for an internal temperature up to 125°C. Provision shall be made for topping up the oil at the top, draining the oil at the bottom, a glass type oil level correctly indicating the oil and required oil levels, and a temperature probe. Cooling shall be of the ONAN type and electrically the transformation should happen according to the vector grouping DYN11 unless differently specified. The transformer shall be equipped with an off-load tap changer making provision for the following deviations from the nominal 400V output: +5; +2,5; 0; -2,5; and -5%. The seal of this tap changer shall not fail under the tank pressure whilst running at maximum temperature, in fact, no oil leaks at all are allowable.

PCB-free virgin transformer oil complying to SANS/IEC 60296 shall be used to fill the tank up to the required level when standing level. Oil test results are to be forwarded to the engineer.

Label indicating the manufacturer, size and capacities of the transformer shall be mounted in the low voltage compartment in such a way that it is visible when the door is opened.

The main LV circuit breaker manufactured by either ABB, CBI, Mitsubishi or Schneider/M&G should have a suitable fault rating for the transformer size, and should be making provision for an overload of 10% from time to time:

200kVA:	300A15kA3phase;
315kVA:	500A15kA3phase;
500kVA:	800A15kA3phase;
630kVA:	1000A20kA3phase;
800kVA:	1250A25kA3phase;
1000kVA:	1600A30kA3phase;and
1250 kVA:	2000 A 40kA 3 phase.

The LV busbars should also be appropriately rated to handle at least 20% more current than the circuit breaker will allow.

Main CT's will be placed around the busbars where the supplying tails enter, and they should be sized as follows:

200kVA:	300/5AClass0,5
315kVA:	500/5AClass0,5
500kVA:	800/5AClass0,5
630kVA:	1000/5AClass0,5
800kVA:	1250/5AClass0,5
1000kVA:	1600/5AClass0,5
1250 kVA:	2000/5A, class 0,5

The panel ammeters faces shall be marked accordingly, indicating the maximum current at their maximum measuring point. There shall be an ammeter for every phase with the borders coloured in accordance with the phase colour. Only one 0-500V voltmeter needs to be supplied and mounted in the LV compartment, with a 7 position switch making provision for all the phase to phase and phase to neutral measurements. The metering circuits shall be protected by HRC fuses.

The low voltage compartment shall make provision for at least 5 circuit breakers and 10 gland positions for cables entering the minisub in the case of minisubs 500kVA and smaller, whereas the minisubs of bigger capacity shall make provision for 6 circuit breaker bays.

A digital display type thermostat may be specified to be included in the low voltage compartment. In this case the thermostat should be wired to trip the MV circuit breaker in case of overheating.

All indicator lighting shall have a mean time between failure rating of at least 25 000h, to be guaranteed by the supplier

In the case a streetlight section is specified, the section should be protected by a fault limiting 60A three phase circuit breaker capable of handling the fault current of the transformer as specified above, except that in the case of a 200kVA transformer a 10kA unit may be used. The streetlight section should further contain a 5/6A circuit breaker protecting the photocell circuit, a 60A three phase class 3 contactor controlled by the photocell, a single 5A bypass switch, and three lighting circuits protected by 20A 10kA circuit breakers.

The minisub plinth top shall always be mounted level +2°.

D. Transformers

Transformers are meant to be installed internally inside transformer rooms, protected by either its supply circuit breaker against at least overload and earth fault, or LV circuit breaker against overload.

The transformer shall comply to SANS 780 and all the standards referenced therein.

Unless differently specified, the transformer shall be of the hermetically sealed tank type, with sufficient space above the transformer oil to allow for an internal temperature up to 125°C. Provision shall be made for topping up the oil at the top, draining the oil at the bottom, a glass type oil level correctly indicating the oil and required oil levels, and a thermometer. Cooling shall be of the ONAN type and electrically the transformation should happen according to the vector grouping DYN11 unless differently specified. If so specified, it shall also be equipped with a Buchholtz relay with voltage free contacts, and the same applies to a thermometer. The transformer shall be equipped with an off-load tap changer making provision for the following deviations from the nominal 400V output: +5; +2,5; 0; -2,5; and -5% .

The seal of this tap changer shall not fail under the tank pressure whilst running at maximum temperature, in fact, no oil leaks at all are allowable.

PCB-free virgin transformer oil complying to SANS/IEC 60296 shall be used to fill the tank up to the required level when standing level. Oil test results are to be forwarded to the engineer.

In the case that an MV circuit breaker is available, the circuit breaker shall trip on the following: Buchholtz relay, overload and earth fault on the transformer. If no circuit breaker is available, the transformer shall be protected against overload with a main LV circuit breaker on the Main Distribution Board as follows:

200 kVA:	300A	15KA	3phase;
315 kVA:	500A	15kA	3phase;
500 kVA:	800A	15kA	3phase;

630 kVA:	1000A	20kA	3phase;
800 kVA:	1250A	25kA	3phase;
1000 kVA:	1600A	30kA	3phase;
1250 kVA:	2000 A	40kA	3 phase;
1600 kVA:	2500 A	50kA	3 phase; and
2000 kVA:	3200 A	65kA	3 phase.

E. Medium Voltage Cabling

All MV cabling are to be supplied in accordance with SANS 97:2012 inclusive of Table 18 as amended and all the standards referenced therein if PILC-type cables are specified, alternative SANS 1339:2010 as amended and all standards referenced therein when XLPE type cables are being specified. If cables are to be taken over or managed by a supply authority, their standards will also be applicable and has to be adhered to. All cable accessories have to comply with SANS 1332:2013 as amended and all standards referenced therein. Only joints and terminations approved by the engineer and /or local authority depending on the case may be used.

F. Medium Voltage Lines

The material of an overhead line comprising of steel, concrete or wooden poles, cross arms, stays, insulators, conductors, isolators, fuse-links, transformers, lightning arrestors, sectionalisers and any other specified auxiliary equipment shall all be new and comply to their respective SANS standards as follows.

Equipment used on overhead lines shall more specifically comply to:

SANS 182:	Conductors for overhead electrical transmission lines (CU, Al, ACSR, CU or Zn coated steel
SANS 470:	Concrete poles for telecom, power and lighting purposes
SANS 657:	Steel tubes for non-pressure purposes
SANS 753:	Pine poles, cross arms and spacers for power distribution, telephone systems and street lighting
SANS 754:	Eucalyptus poles, cross arms and spacers for power distribution and communication systems
SANS 1418:	Aerial Bundle Conductor systems
SANS 10280:	(NRS041) Overhead powerlines for conditions prevailing in South Africa
SANS 50483:	Test requirements for LV ABC accessories
SANS 60099-8:	Metal Oxide surge arrestors for overhead transmission/distribution lines > 1kV
SANS 60305:	Ceramic or Glass Insulators for overhead lines > 1kV
SANS 60383:	Test methods etc. for Ceramic or Glass Insulators for overhead lines > 1kV
SANS 60720:	Characteristics of line post insulators
SANS 60826:	Design criteria for overhead transmission lines
SANS 61109:	Composite insulators for overhead lines > 1kV
SANS 61284:	Requirements and tests for overhead line fittings
SANS 61466:	Standard strength classes and end fittings for composite string insulator units
SANS 61643:	Low voltage surge protective devices
SANS 61952:	Test methods etc. for Composite insulators for overhead lines > 1kV
SANS 62271-111:	Automatic circuit reclosers and fault interrupters < 38kV

All steel and iron work including mild steel straps shall be hot dip galvanised to SANS 14713.

Before starting installation wayleaves shall be obtained from all and any supply or service delivery authorities such as the local municipality, Telkom, DFA, Transnet, Transport Services, National, Provincial or Municipal Road Authorities, etc. which may cross the power line. The contractor shall further acquaint himself with all and any services crossing the future line and take full responsibility for any damage to any service or services.

The route shall be pegged by a suitably qualified land surveyor according to plans submitted, and should any obstacles be found any deviation needs to be approved by the engineer up front.

The contractor shall ensure that all the safety distances as depicted in NRS 60 Table 6 be adhered to, taking into account line sagging when running full load on hot days. Regarding spacing between lines the following minimum distances shall be adhered to:

Pole	LINE VOLTAGE		
Spacing (m)	< 6,6kV	11kV	22 kV
	Conductor spacing (mm)		
60	575	635	790
70	635	700	850
80	700	750	910
90	750	810	975

Any joints and clamps shall not reduce the current carrying capacity nor the mechanical strength of the conductors and shall be constructed and applied according to manufacturers recommendations and requirements. Stays shall be properly anchored with kicker plates, base plates or blocks as may be required, and shall normally be at an angle of 45 degrees to the pole they are supporting. Stay wiring shall be able to withstand a breaking stress of 695MPa. The use of strut poles should be minimized and may only be used after instruction from the engineer. All poles shall be planted vertically in all directions and be buried 1,8m deep, unless otherwise instructed.

All non-current carrying metallic parts shall be properly bonded to earth, with a galvanised steel down conductor to earth of minimum size 35mm² to an earth with resistance not exceeding 3 ohm in the case of line voltage < 6,6kV, 3,8 ohm in the case of 11kV, and 6 ohm in the case of 22kV.

Lightning arrestors shall be installed at every cable connection, sectionaliser, recloser, and connection points to secondary lines. They shall be mounted below the overhead conductors and be suitably earthed.

Fuse links shall be of the type where all phases trip in the case of a fuse blowing, and shall be installed at all transformers and connection points to secondary lines.

The line shall be pressure tested before putting it into operation.

Danger notices shall be fitted to all structures, and poles shall be sequentially numbered with permanent labelling properly and permanently fixed to the poles.

Where so instructed, anti-climbing devices shall be installed.

G. Low Voltage Circuit Breakers

The circuit breakers with a fault breaking capacity exceeding 10kA has to comply with the latest edition of SANS 1973 and all standards referenced therein, whereas circuit breakers of 10kA and smaller fault breaking capacity do need to comply to the latest editions of SANS 556 in its subtitles. Only reputable manufacturers products such as ABB, CBI, Merlin Gerin (Schneider Electric) and Mitsubishi will be allowed to be used. In the case where higher temperatures may be experienced only magnetic hydraulic type - and not the thermal type - circuit breakers are to be utilised.

All earth leakage (SANS 556-2) units have to trip before a leakage current of 30mA is exceeded, and not trip at a leakage current of 18mA or less, unless otherwise specified. In all installations other than residential installations, circuit breakers shall have a fault current handling capability of at least 5kA. All circuit breakers shall be able to handle the fault level present, normally indicated on the single line diagrams.

H. Low voltage cabling

All low voltage cabling shall comply to the requirements of SANS 1507 in its subtitles as applicable. All cables laid into the ground or exposed to natural elements shall be steel wire armoured, whereas only those used internally on cable racks may be unarmoured. The requirements of SANS 10142-1 shall be applied throughout regarding the fixing and terminations of the cables. All terminations shall be properly terminated with glands complying to SANS 1213 and standards referenced therein, and the armouring shall be earthed on the earth bar. Sizing of cabling to be checked in accordance with the loading tables with derating factors as set out in SANS 10142-1.

I. Distribution Boards

All distribution boards shall comply to the requirements of SANS 1973-1, SANS 1973-3 and SANS 60439-3, and preferably be pre-manufactured complete with all circuit breakers, bus bars and tails pre-installed by the DB manufacturer in accordance with the drawing(s) supplied by the engineer with at least 25% spare space for future expansion. In these cases, a formal quote is obtained and first needs to be evaluated by the engineer before ordering may proceed, and the contractor is entitled to a handling fee over and above the quote. Unless otherwise specified, the DB's shall be configured in accordance with the specific drawings and bill of quantities,

and shall contain surge arrestors in accordance with the requirements of the applicable parts of SANS 60099. In the case of flush mounted boards, the electrical contractor may supply the base for the main building contractor to install in the wall, although the electrical contractor stays responsible for correct positioning. DB's shall be manufactured from 2mm thick mild steel and epoxy coated if for internal use, or from galvanised 2mm thick mild steel or 3CR12 in the case of external installations. In the case of flush mounting the galvanised mounting trays are to be supplied with the DB's and price to be included in the quotes thereof.

All busbars to be of appropriate size as determined by their protecting circuit breakers, whereas the earth bar shall comply to the requirements as stated in Table 6.25 of SANS 10142-1.

All circuit breakers are to be able to withstand the stated fault level, and if cascading is applied this shall be properly indicated by an appropriate label.

The IP rating of the DB shall be appropriate for the stated environment.

DB's are to be checked by the engineer at the factory before they are transported to site.

J. Metering

In the case of conventional meters, meters shall be suitable to handle the different time of use tariffs by recording the consumption in accordance with the published times of peak, standard and off-peak times in different registers, and being able to report both the total consumption and maximum demand over these periods. They further shall comply to the requirements of the latest edition of SANS 62051 and be compatible with remote reading of the meter. The meter type and manufacturer is normally detailed in the bill of quantities and shall be adhered to.

In the case of pre-paid metering the meters shall comply to all the requirements of the latest edition of SANS 1524 in all its sub specifications, and be compatible with the local vending system in use. The meter type and manufacturer is normally detailed in the bill of quantities and shall be adhered to.

All meters to be wired correctly, be programmed correctly in accordance with requirements, VT and CT ratios where applicable, and indicate consumption in the correct quadrant. If in error, meter verification will be done at the cost of the contractor.

K. Cable ways

Cables should either be routed through trenches, sleeves, cables ladders, cable trays, and/or conduits.

In the case of sleeves, the bill should state clearly whether galvanised steel or PVC tubing is to be used, and the expected diameter of the sleeve. When PVC or high-density poly ethylene is specified it should be of the external ribbed type sleeve with a smooth inner lining such as Nextube, and should be black for electrical cables and green for Telkom cables. Other colours may be specified for specific purposes. Sizes smaller than 100mm diameter are normally class 6 waterpipes and black, except when orange piping for fibre optic cabling is required. The sleeves shall comply to BS EN 50086-2-4 regarding compression and impact tests and shall be provided with a suitable coupler which prevents the ingress of sand or similar material, whilst not having to be watertight. Pricing per meter includes laying, cutting and jointing.

Cable ladders and cables trays supplied should be in accordance with the bill of quantities regarding sizing and be manufactured by Cabstrut or another manufacturer with prior approval of the engineer. Joints should be the same strength as the ladder or tray as per SANS 10142-1 and each length shall be separately earthed - earthing may not depend on the mechanical joint. All ladder and tray material shall be made of galvanised steel unless otherwise specified and be of the heavy-duty type. Pricing per meter includes all brackets, hangers, fixing and jointing materials.

All conduits shall be made of either galvanised steel or unplasticised polyvinyl chloride (U-PVC) and comply with the requirements of either SANS 1065-1 and SANS 60423 (Galvanised) or SANS 950 (U-PVC), both complying to SANS 61386 and be installed in accordance with the requirements of Appendix C of SANS 950. Flexible conduit should comply to the most recent edition of SANS 60614-2-5. Attention should be given to the diameter required as per drawing and bill of quantities.

L. Powerskirting and Power Poles

Powerskirting and power poles to comply to the latest edition of SANS 61084-1 and the standards referenced therein. All equipment mounted into the power skirting such as 16A sockets, RJ11 and RJ45 sockets etc. should be made to fit properly into the powerskirting or power poles without the risk of it getting disassembled when pulling a plug out a socket or being hit by some external object. Power skirting would normally have at three

channels, 50% for power, and 25% for data and telephony each. Unless otherwise specified, metallic power skirting is to be supplied.

M. Luminaires

Luminaires have to comply to the relevant clauses of the latest edition of SANS 475, 1464, 60570, 60598 and 61347. Where low voltage luminaires are used the transformers should comply to SANS 61558-2-6 and they should be fully isolating.

The engineer will normally specify in correlation with the architect the manufacturer and model of the luminaires required, and quotes will be obtained. The engineer will approve a quote after evaluation whereupon the contractor has to order accordingly. The contractor may specify a handling fee as a percentage of the final cost or procurement. Luminaires have to be handled, stored and fitted in accordance with the manufacturers' recommendations or specifications.

In those cases where the manufacturer does not supply a 6A socket with 3m lead for the different types of downlighters and/or drop in luminaires, they will have to be quoted on and procured separately.

Refer to Annexure A for lighting schedule.

N. Sockets and switches

Unless otherwise specified, all sockets and switches are to be mounted in standard 50x100 or 100 x 100 boxes which have to comply to latest revision of SANS 1085, whereas switches have to comply to SANS 60669-2-1 (VC8003) and the standard sockets to SANS 164 (VC8008) according to its sub-specifications. Industrial sockets need to comply to the latest revision of SANS 1239 and SANS 60309-1, whereas stove couplers have to comply to SANS 337 and SANS 60309-1. Sockets have to be mounted in such a way that water ingress is unlikely at the height of 300mm above ground level unless otherwise specified on the drawing(s), and industrial sockets with its earth pole in the 6 'o clock position. Sockets above work surfaces should be mounted 300mm above such surfaces instead of 300mm above ground level.

Sockets delivering a different voltage (for eg. shavers) should not be of the form specified above, the voltage should be clearly marked, and should make use of an isolating transformer complying to SANS 61558-2-5.

Sockets and switches to be used outside have to be mounted in a weatherproof box or be inherently weatherproof in accordance with SANS 190142-1, irrespective whether a plug has been plugged into the socket or not, and irrespective of the switch position.

Please note that in accordance with SANS 10142-1 it is no longer allowed to install a SANS 164-1 socket (old type 16A socket) on its own, but should always be accompanied by a SANS 164-2 type 16A 3-pin socket (3-pin Euro/Slimline).

O. Timers, time switches, photocells and contactors

Timers and time switches shall comply to the latest edition of IEC 60730-2-7, with mechanical timers having a reserve of at least 24h and digital timers at least 72h. Only timers equipped with at least 16A contacts internally may be used. If higher currents or starting currents are to be expected, the switching should be through a contactor with is controlled by the timer. Timers should preferably be mounted next to the circuit breakers on the rail carrying the circuit breaker.

Photocells, also known as photo-electric daylight switches or day-night switches, shall also be able to handle 16A on its change-over switch, and shall switch on when general lighting level reduces to lower than around 50 lx, and switch off again when general lighting levels exceed around 100 lx, with a delay of at least 15s between operations to prevent chattering of the contacts. Photocells shall be so positioned that their operation is not affected by artificial lighting.

Contactors are to comply to SANS 60947-4-1 and are to be at least class 3 to be able to handle 100% duty. Their energising coils should be able to handle the specified or nominal voltage plus or minus 10% on a continuous basis without chattering or burning out.

Bypass switches of appropriate size shall be installed for all timers and photocells to enable operation and/testing during off-times.

P. Generators

Generators to comply to SANS 8528 all applicable parts and be made according to specification as stated in the bill of quantities or separate specification, but its parts shall comply at least to the following requirements:

Controller: Deep Sea Electronics or Lovato, or as approved by the engineer

Engine: Perkins, Volvo, Scania or John Deere
 Alternator: Marelli, Stamford, Meccalte, or other approved by the engineer, complying to SANS 8528-3
 Changeover switch: Socomec, ABB or Schneider Electrical to comply to SANS 60947-6-1 & 8528-4
 Attenuation: Noise < 65dB at 7m. The required silencer and silencing material to be included
 Rating: 100% at altitude of location
 Power factor: 90% (Prime), or 80% (Standby) as specified
 Fuel tank: Large enough for at least 14h of operation at full load, unless otherwise specified, but not exceeding 999 liter unless otherwise specified.

Delivery, commissioning, first tank of diesel and maintenance for 12 months shall be listed separately but included in the total cost.

Generators shall comply to the Environmental requirements as stated in SANS 10103, and measured 7m from the set the noise levels shall not exceed the following values as extracted from same standard:

District Type	Equivalent Continuous Rating Level (dBA)					
	Outdoors			Indoors		
	Day-night	Day time	Night time	Day-night	Day time	Night time
Rural residential	45	45	35	35	35	35
Suburban with little road travel	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban with some workshops, businesses and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Day time: 06:00 - 22:00

Night Time: 22:00 - 06:00

Q. Security

All security, alarm and CCTV equipment are to comply to the following SANS standards as applicable, according to their latest edition:

SANS 2220 and sub divisions: Intruder alarm and access control systems
 SANS 10222 and subdivisions: Electrical Security Installations and Electric Fences
 SANS 60335-2-76 regarding Electrical Fences
 SANS 10222-5 and subdivisions: CCTV Installations

All data cable material has to comply to the requirements as stated in the BoQ. Specific attention has to be given to the type of cable required, be it multicore pilot, telephony, ethernet, power over ethernet or fibre optic cable. They all have to comply to their respective standards. All wiring has to be planned up front, in order that they can be routed through wireways and not just be glued to walls.

When required, because of a wide variety of possibilities, intercom systems are specified in more detail in the Bill of Quantities or a separate detail specification. All intercom and public address systems shall have a minimum

mean time between failures of 50 000h, to be guaranteed by the supplier. If a multiple point intercom system is specified, it should at least have the following functionality:

“All call” – with the call relayed over all connected extensions whilst the operator holds the button and speaks;

“Group call” – with the group selected by switch, and the call relayed to all extensions of the group whilst the operator holds the “Talk” button;

“Single Call” – with the single extension selected the communication is relayed to the single extension only;

“Incoming call” – where any station requests communication, the operator can select this station and talk;

“Signal” – where a tone is sent out for the duration the button is pressed.

Compliance is expected to any further requirements as stated in the Bill of Quantities and/or separate specification.

Regarding electrical fencing a separate Certificate of Compliance is to be issued to the Principle Agent/ Developer and/or owner with a copy to the electrical engineer

R. Lightning protection and earthing

Lighting protection materials and installation has to comply to the latest editions of SANS 10313 and SANS 62305 and its subdivisions, and any standards mentioned therein.

Regarding earthing materials and joints have to comply to the latest editions of SANS 1063, SANS 10198-3, 10198-12, 10199, 10200, and 10292. The earthing system shall be in accordance with the requirements of SANS 10142-1.

The design shall be made available to the engineer before work proceeds, and shall include the safety report completed as planned as depicted in SANS 10313:2012 for approval

Once the work is completed, a separate Certificate of Compliance complete with safety report as installed is to be issued to the Principle Agent, Developer and/or owner with a copy to the electrical engineer.

S. Photovoltaic installation

Photovoltaic systems shall comply to the relevant clauses of SANS 959 and/or SANS 60364-7-712, the panels shall comply to SANS 959, SANS 60125, SANS 62730-1 and/or SANS 61646, its DC fuses shall comply to SANS 60269-6, the converters/inverters to SANS 61850-90-7, SANS 62109-1, and where applicable the energy storage to SANS 61427. Surge arrestors shall comply to the relevant part of SANS 60099. The installation has to comply to SANS 10142-1 Clauses 7.12 and NRS 90 and 97 regarding paralleling to the existing installation and the following must be ensured at all times in terms of these:

- The peak generation shall not exceed 25% of the maximum demand of the supply measured over the past 12 months;
- The peak generation at any connection point shall not exceed 50% of each upstream transformer; and
- Back feed into the supply shall be impossible.

Any requirements of the local authority supply authority shall be adhered to, and permission for installation and/or connection be obtained before energizing.

No PV system shall be installed without a structural engineers' certificate regarding the suitability of the structure to carry the (extra) load of the solar panels, and without an evaluation regarding impact on the lightning protection system and whether modifications to this is required. The cost of any modifications required should be included in the cost benefit evaluation.

T. Service conditions

The following standard low voltage service conditions apply, and all equipment supplied must be able to handle the following on a continuous basis:

3 phase line voltage:	400V + 10%
Single phase voltage:	230V + 10%
Frequency:	50 Hz + 5%
Altitude:	As per specified location, between 0 and 2000m above ASL
Lightning and dust:	Severe conditions, depending on location.
Average power factor:	0,8
Maximum Humidity:	95%
Atmospheric temperature:	Depending on location, generally between -5 and +45°C
Max fault current:	Depending on transformer, see BoQ for requirements
If location is within 50km from the coast, coastal specification for equipment should be used throughout.	

Where the supply is medium voltage, the following will apply:

3 phase delta voltage:	As per location: 6,6, 11 / 22kV +10%
Rupturing capacity:	250MVA
Min equipment fault current:	20kA
Impulse level:	95kV
The other are as above	

U. Distribution Cubicles and meter boxes for external reticulation

Distribution cubicles and meter boxes shall comply to the requirements of the supplying authority and be installed in the positions as indicated on the approved plan(s). They shall be made of materials as approved by the relevant authority and be obtained from an authority approved supplier.

V. Lighting poles and masts

The poles or masts shall be in accordance with the bill of quantities and drawing regarding material, mounting height, outreach and planting depth, and be suitable to carry the full luminaire loading even in cases of 120km/h storms without permanent deformation. Masts shall be designed and manufactured in accordance with SANS 10225. When manufactured from mild steel poles and masts shall be thoroughly cleaned according to SANS 10064 and hot dip galvanised in accordance with SANS 121 and SANS 14713-2. Provision shall be made at the required height accessible through a weatherproof cover plate for a 5A 5kA circuit breaker protecting the circuits to and the luminaires themselves, with provision for cable glanding for 3 cables up to the size of 16mm² 4 core armoured cables.

In the case of masts they shall be supported by a civil/structural engineer designed concrete base, and in the case of street lighting next to roads they shall be mounted on a stubby supplied with the pole to ease pole replacement in the case of accidental damage.

3 WORK AND WORKMANSHIP SPECIFICATION

All work is to be of high standard in accordance with the stated quality requirements and standards, especially those of SANS 10142-1 and -2, and the standards referenced therein. It is expected from the contractor to issue a Certificate of Compliance covering all the work done to the client with a copy to the engineer.

Furthermore, all work has to be done in a safe manner and in accordance with the requirements of the Occupational Health and Safety Act, Act 85 of 93, and all the applicable regulations issued in terms of this Act.

More specific the following is specified in more detail:

A. Medium Voltage Work

All medium voltage work has to be of a high standard and be done in accordance with the requirements of SANS 10142-2.

Substation building floors are to be level to within 1mm over the length and width of the substation before medium voltage panels can be installed. The electrical contractor is to supervise the manufacturers team whilst they are building and bolting the panels together, and doing their control cables. Once the work is ready and testing can commence, the engineer should be informed that he can attend the testing. All work and cabling to be neatly laid and where possible properly bound to structures such as cable trays.

Manufacturers recommendations regarding the handling and bending of cables have to be adhered to, and any damage to cables will be to the cost of the contractor.

Jointing and terminations shall only be done by properly qualified and approved jointers, and where applicable they have to be approved by the supplying authority. Manufacturers recommendations have to be strictly adhered to. Any joint failing within the retention period shall be repaired by the contractor at no cost to the client.

All external equipment such as minisubs and ring main units are to be placed on level concrete bases with minimum height of 300mm and of the correct size to prevent any ingress of rodents and insects, and these bases are to be placed level within 2° of the horizontal in all directions. Any sagging of these bases in any direction within the retention period will have to be addressed by the contractor without any cost to the client.

B. Cable trenches

Regarding cable routes to be trenched, the routes in accordance with drawings issued have to be followed. Any deviation caused by practical obstacles shall be discussed with the engineer before proceeding, be properly recorded and indicated on the as built drawings.

A way-leave should be obtained from the respective authority before any trenching or work in public areas may proceed.

Medium voltage cables are to be laid at least 900mm under final ground level, and to be bedded in soft soil free of stones or other material that can damage it in a layer extending at least 100mm below and above the cable. This may be locally sifted or imported soil.

Low voltage cables are to be laid at least 600mm under final ground level, and the same bedding requirements apply.

All trenches are to be inspected by the engineer before the trench may be closed. If this is not adhered to, re-opening of any trenches will be to the cost of the contractor. Trenches are to be level and free of any boulders, stones and debris before bedding is applied.

Cable trenches are to be properly shored in the cases of loose soil or trenching going deeper than 1,5m to prevent it caving in.

In the case blasting is required, a properly qualified blaster shall be used, and the cold chemical method of breaking is preferred, especially in built up areas.

Mechanical excavators are not to be used in the vicinity where services are to be expected, and only after cross cuts have been made. Where mechanical excavators are being used, a supervisor shall be present at all times to ensure safety of the people, other services and the excavation.

Trenches should be backfilled in 150mm layers, each layer to be properly compacted to Aastho 93 standard. Any sagging during the retention period shall be repaired by the contractor at no cost to the client.

Any top layers have to be reinstated as they were before the trenching started. This includes tar, paving and/or gardening.

Sleeves in trenches have to be laid in parallel with at least 50mm of soil between them to assist in heat dissipation. Sleeves through watery areas have to be concreted in in such a way that floods won't disturb them.

Cables of different voltages may be laid in the same trench on condition that a distance of at least 300mm is maintained between the lower and higher voltage cables. The same distance is to be applied to other services in the trench.

Attention is drawn to the requirement that normally the supplier's cable may not be laid in the same trench or wireway as the wiring of the internal reticulation.

C. Cable ladders and trays

All cable ladders and trays shall be installed on routes as indicated on the drawings at the height as stipulated to miss any other services in the ceiling void. They shall be installed straight, level and as far as possible parallel to the walls, with the joints as strong as the rest of the trays, and hung or fixed with the equipment as recommended by the manufacturer in such a way that they will be able to carry the full load as specified without bending or diversion.

Cabling of different voltages laid together shall be insulated in accordance with the highest voltage present.

D. Equipment installations

All equipment, which includes DB's, Sockets, Luminaires, switches, stoves, geysers etc. are to be installed in the positions as indicated for each on the drawing(s), and further in accordance with all and any requirements of the applicable standards, more specifically SANS 10142-1.

Sockets (middle point) are normally installed 300mm above final ground level, whereas switches are to be installed 1200mm above final ground level. Sockets above wall mounted working tables or surfaces are also to be installed at 1200mm or 300mm above such surface, and so should stove isolators also be mounted at 1200mm height not further away than 1200mm from the equipment to be isolated, but not above any heating surface. Underfloor heating supplies and controllers should also be installed 300mm above final floor level, whereas power skirting is normally mounted against the wall on top of the floor. Light switches to be installed at a height of 1200mm above ground unless specified differently.

All equipment shall be functional and properly working at handover, and any issues found after handover within one year of handover date to be addressed by the contractor at their own risk and cost, up to and including full replacement and re-installation, unless it can be proven that the issue was caused by misuse

or mismanagement of the user.

E. Wiring installations

All general purpose wiring has to be routed through conduits and conduit accessories. No wiring, even in cases where SANS 10142-1 would allow it, is to be concreted or plastered in directly, but has to run through conduits or other wireways as may be applicable. Where allowed by the engineer, lighting supplies may be strapped to specially installed cables in the ceiling void on condition that the 6A lighting supply sockets are properly fixed to one or other fixed structure or immovable object. No wiring, irrespective of type, is to be laid directly on top of the ceiling or routed directly on top of or hanging from trusses or other building structures and fixtures. Cables should also be run through trunking in or on top of the walls and should not be saddled onto walls, trusses or other building fixtures. Solid (non-stranded) wiring may only be used where specified in the BoQ/drawings or by up front permission obtained from the engineer. The purpose of the wiring shall be clear at all ends.

The following sizes of wiring should be used and protected as indicated, unless otherwise specified either on the single line diagram or cable schedule:

Typical purpose	Circuit breaker	Wiring size
Monitoring & control wiring	5 or 6 A	1 or 1,5mm ²
Lighting	10 or 15A	2,5mm ²
16A sockets	20A	4mm ²
Air conditioning	25A	4mm ²
Stove/oven connection:	32/35/40A	6mm ²

Other cabling is to be in accordance with the drawings and/or cable schedule. Where it is clear that the cable size does not correspond to circuit breaker size, the issue shall be taken up with the electrical engineer for decision.

The requirements of SANS 10142-1 regarding maximum amount of wiring in conduits, trunking and trays shall be strictly adhered too. No data and power wiring shall be routed through the same wireway. Attention is drawn to the requirement that normally the supplier's cable may not be laid in the same wireway as the wiring of the internal reticulation. The supply shall always be connected to the top of circuit breakers, and the load to the bottom terminals of circuit breakers. This also applies to pre-manufactured distribution boards.

F. Earthing

Earthing shall comply to the requirements as set out in SANS 10142-2 (MV), SANS 10199 and SANS 10292, and all bonding to the requirements of SANS 10142-1. Earthing rods are to comply with SANS 1063. MV switchgear should be earthed to a level lower than 3 ohm, transformers (and therefore substations containing transformers also) as per SANS 10142-2 to be less than 1 ohm, whereas pure LV earthing depends on the MV supply level, but should generally be less than 10 ohm. At these resistance levels MV and LV earthing may be combined. No aluminium or Kwenä cable – unless insulated - can be used as conductors in the soil, but both can be utilized above ground in the case of possible theft. Proper joints are to be made at the point where earthing conductors enter the soil if different materials are used.

G. Lightning Protection

Normally the lightning protection will be done by a lightning specialist company under the supervision of the electrical contractor. The electrical contractor therefore needs to check that standards are adhered to, especially regarding type and quality of materials, test points, earthing and the deriving of the Certificate of Compliance. The following, where possible, shall be adhered to:

Earth mats or grids should be underneath the foundation. If not possible, they shall be in a position as indicated on engineering drawings;

Down conductors to be inside walls in conduits. If not possible, they shall be done in accordance with negotiations with the architect and electrical engineer.

Test joints to be installed on all down conductors in 4x4 boxes about 0,5m high above final expected ground level. Earth resistances as measured at each test point shall be added to the lightning Certificate of Compliance. All test joint boxes are to be labelled indicating their purpose.

H. Notices, Labelling and Legends

All notices and labelling to comply to the requirements of clause 4.2 of SANS 10142-1 2nd Edition, and to be of permanent nature even if operating temperatures increase to 70 °C. Where applicable, labelling or legend inscriptions in DB's should not only indicate the purpose but also the area, for example "Sockets Kitchen" or "Lights Passage West".

Commissioning

The purpose of commissioning is to ensure proper functionality according to design intent and clients' requirements. To this purpose it shall consist at least of the following actions, depending on what was supplied and installed:

- Check insulation of all wiring with a 1000V insulation tester for LV wiring, and MV value + 20% for medium voltage cabling;
- Check all terminations and joints regarding being fixed and properly terminated;
- Check all wiring and cabling to be properly protected according to size with suitable overload protection;
- Check correct functionality of all equipment, including light switches, especially if more than one switch controls a circuit;
- Check all switches and circuit breakers working in the same direction;
- Check correct wiring to all sockets and check earth leakage functionality on all sockets;
- Check earth leakage unit test buttons in DB's;
- Check that all equipment is earthed and/or bonded in accordance with the requirements of SANS 10142-1;
- Check that all testing in according with the different certificates of compliances are done and the certificates duly completed;
- Check that DB's comply to all SANS requirements;
- Check correct functionality of automatic standby generator changeover in the case of a power failure;
- Check that generator can handle the full load;
- Check all certificates received from suppliers for sufficiency, correctness and guarantees;
- Compile commissioning documentation;
- Compile final account.







Completion







On completion the following has to be handed over to the client through the engineer:





- All applicable certificates of compliances, duly completed and signed
- All maintenance manuals for maintainable items such as generators and transformers
- Descriptive brochures and/or pamphlets of all equipment in the installation;
- All drawings, properly updated according to the as built situation;
- Fully completed final account, including the costs for all assets.

ANNEXURE A

LIGHTING SCHEDULE

Code	Description	Image
A1	600x600mm, 34W recessed LED light fitting, rolled with mild steel body with a matt white epoxy powder coated finish	
A2	600x600mm, 34W recessed LED light fitting, rolled with mild steel body with a matt white epoxy powder coated finish, with emergency backup power	
B1	280mm, 7W recessed LED floor light fitting installed in auditorium walkways. Finish – natural and black anodized. White powder coated	
B2	280mm, 7W recessed LED floor light fitting installed in auditorium walkways. Finish – natural and black anodized. White powder coated. With emergency backup power.	
F12	600x600mm, 30W, ceiling recessed LED panel light fitting, fitted with aluminum body rated IP44, cool white.	
F20	1200x600mm, 30W LED panel, ceiling recessed light fitting fitted with aluminum body rated IP44, cool white.	

C1	103mm diameter ceiling recessed, Die cast aluminium body light fitting with white acrylic lens installed with 8W LED lamps, warm white.	
	Recessed linear LED lighting, with 14W/m LED strip lights encased in aluminium extrusion/channel with flat opal diffuser.	 
	5W LED Strip Lighting	
F01	1200mm, 20W, surface mounted LED Batten, with rolled mild steel body with a white epoxy powder coated finish.	
D1	127mm diameter ceiling recessed, Die cast aluminium body light fitting with white acrylic lens installed with 21W LED lamps, warm white.	

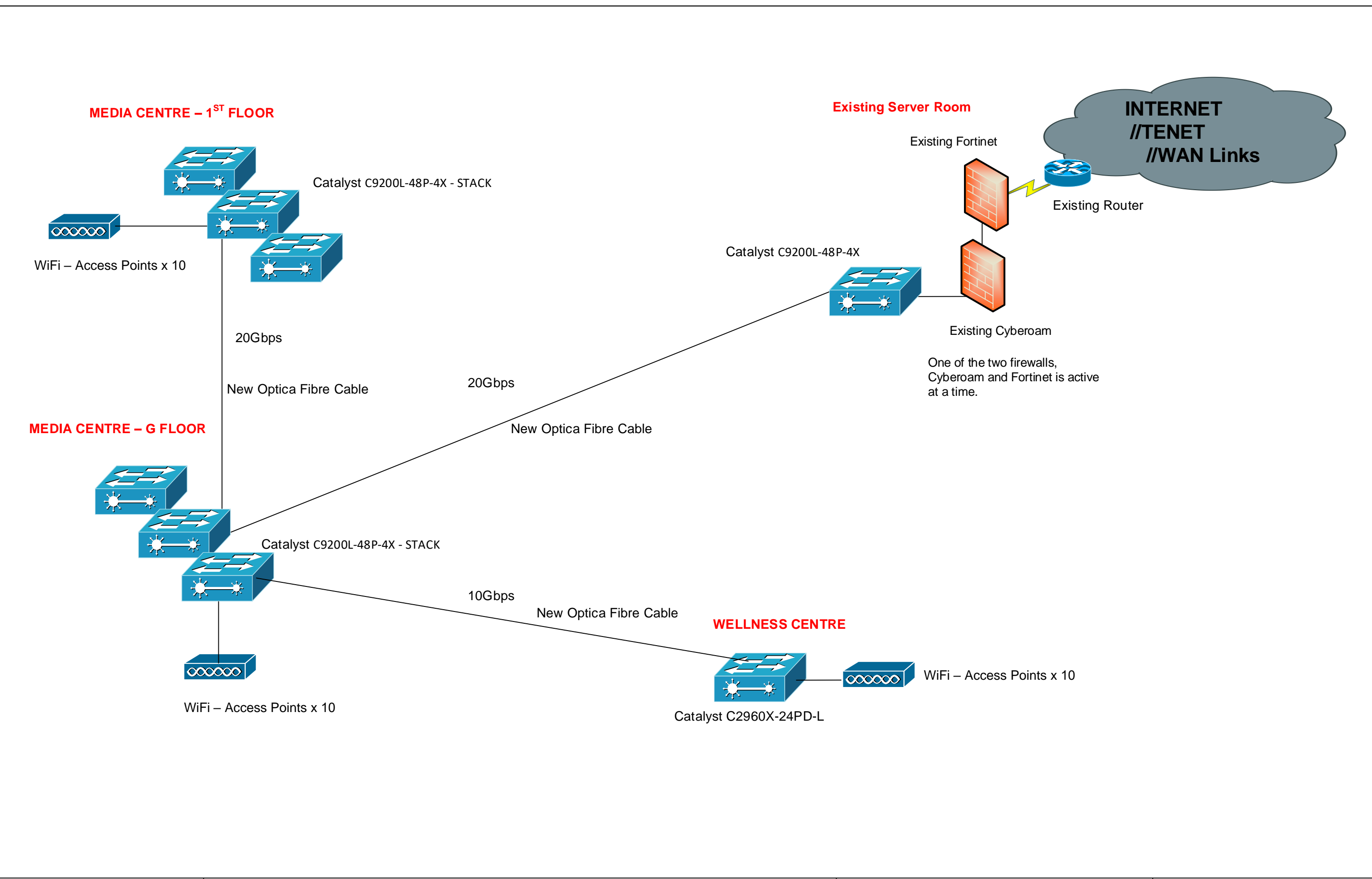
P1	1200mm diameter, 38W, 6052 lumens, Suspended Pendant Light fitting, with UV Stabilised acrylic diffuser	
P2	25W double sided LED light fitting with aluminium body fitted with LEDs per side IP65 rated	
B3	30W LED bollard with clear diffuser, Buried mount complete with lamp. Powder coated Black	
P3	Double sided LED accent lighting fitting with aluminium body fitted with 2x17W LEDs per side IP65 rated	
S1	58W Suspended LED Profile Light Fitting, with frosted acrylic diffuser and extruded aluminium body.	

Ekurhuleni East TVET College

Wellness Centre – Lighting Schedule

Code	Description	Image
F12	1200x600mm, 50W LED panel, ceiling recessed light fitting fitted with aluminum body rated (IP44)	
F20	600x600mm, 30W LED panel, ceiling recessed light fitting fitted with aluminum body rated IP44	
F01	1200mm, 20W, surface mounted LED Batten, with rolled mild steel body with a white epoxy powder coated finish.	
B1	334mm diameter, 150W suspended LED high bay light fitting with aluminium housing and standard and powder coated finish	
F30	55W high-performance LED linear lighting with steel housing and standard 5-pin wiring for trunking rail	
C1	103mm diameter ceiling recessed, Die cast aluminium body light fitting with white acrylic lens installed with 8W LED lamps, warm white.	

D1	232mm diameter ceiling recessed, Die cast aluminium body light fitting with white acrylic lens installed with 22W LED lamps, cool white.	
W1	Outdoor wall mounted 20W LED bulkhead light fitting with die-cast aluminum body	
B2	Outdoor ceiling mounted 20W LED bulkhead light fitting with die-cast aluminum body	





EKURHULENI EAST TVET COLLEGE

"Committed to Excellence"



EKURHULENI EAST TVET COLLEGE, MEDIA AND WELLNESS CENTRE

SPECIFICATION DOCUMENT

ICT INFRASTRUCTURE

SEPTEMBER 2020

REV 01

CONSULTING ENGINEERS	PREPARED FOR:
	
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INTRODUCTION

1.1 Background

The Ekurhuleni East TVET College (client) has appointed Pro-Serve Consulting to review the designs of the previous consultants and proceed to tender and procurement in the construction of new Media Centre and new Wellness Centre at TVET College in KwaThema, Springs in Gauteng Province.

Pro-serve Consulting then appointed HDM Engineering to carry out electrical and mechanical design, which extends to ICT Infrastructure for the Media Centre and Wellness Centre.

The key focus areas for this document is the ICT infrastructure provisioning for the proposed Media Centre and Wellness Center at Ekurhuleni East TVET College in KwaThema Campus.

1.2 Purpose

The purpose of this specification document is to provide detailed technical specification for the following areas of the project:

- Supply, Installation & Configuration of ICT Network Infrastructure (LAN)
- Supply, Installation, Labelling & Testing of Structured ICT network Cabling
- Supply, Installation & Configuration of Server Infrastructure
- Migration of All ICT equipment from old server room to new server room

DELIVERY ADDRESS

The project shall be carried out at the following address:

Ekurhuleni East TVET college
Sam Ngema Rd, 700 Scheme
KwaThema
Springs
Ekurhuleni - Gauteng
South Africa
GPS: S 26° 17'20.93'', E 28° 24' 32.22''

CONTRACT WORK

The installation shall be carried out entirely by the suppliers' own staff and shall not in any way be sub-contracted. This part of the specification is specific to this project and shall in the event of discrepancies have preference over any other part of the specification.

ACCESSORIES AND MISCELLANEOUS EQUIPMENT

1.3 Data Wireways

The contractor shall provide and install wireways, conduits, boxes and outlet facilities where required as shown on the relevant drawings.

All conduits shall be 25mm diameter and be provided with galvanised steel draw wires.

1.4 Contract Price Adjustment Provisions

The Contract Sum shall be subject to price adjustment in accordance with the contract price adjustment provisions as set out in Part A of the tender documents.

SITE

The Tenderers must, before submitting their tenders, acquaint themselves with the local conditions of the site, accessibility of the site, current server room location, new server room intended location, current ICT cabling standards, current server infrastructure and all other factors they may deem necessary for the completion of the total contract. No claim based on ignorance in this regard shall be considered.

Permission must be obtained from the Client before any Tenderer visits the site, or the appointed contractor establishes himself on the site.

SCOPE OF WORK

The work covered by this contract comprises the complete ICT infrastructure upgrade as set out below.

The scope of work includes the following:

1. Supply, Installation & Configuration of ICT Network Infrastructure (LAN UTP/ Fibre cabling, Managed switching, Wireless Network)
2. Supply, Installation, Labelling & Testing of Structured ICT network Cabling
3. Supply, Installation & Configuration of Server Infrastructure
4. Migration of All ICT equipment from old server room to new server room

INFORMATION

- Tenderers are cautioned that should any Schedule of Information in this specification that has to be submitted, as part of the tender is not complete, his/her tender cannot be adjudicated and may be disqualified.
- The Service provider shall be responsible to supply necessary documents such as Installation Guide, Administration Guide, Manuals, and Data Sheets etc.

SPECIFICATION AND DRAWINGS

The specification and drawings generally show the character and extent of the proposed work, and shall not be held as showing every minute detail of the work to be executed.

Tenderers must ensure that their copy of the specification is complete.

1.5 Contract Drawings

The layout and extent of the Data cables installation is shown on the drawings that form part of this document, **See Annexure D**

The appointed contractor must confirm the positions of all ICT cabinets, Data points outlets and data cable routes including Fibre routes that may be affected by other services with

the Consulting Engineer before placing such outlets. Replacement of existing fittings shall be installed at same position as previously installed.

The table below list all ICT Data drawings that form part of this document

Drawing Title	Drawing Number
Media Centre Ground Floor – ICT cabling layout	1082-ICT-001
Media Centre First Floor – ICT cabling layout	1082-ICT-002
Wellness Centre – ICT cabling layout	1082-ICT-003
ICT Network Design	

1.6 Supply, Installation & Configuration of ICT Network Infrastructure

See **Annexure A** for detailed Network Infrastructure Specification and **Annexure D** for Detailed Network Design.

- All new switches will be placed in the new server room (in the 43U cabinet) and in the new 15 U Swing Cabinets, as per their designation
- The current Cisco switch shall remain in the old server room and continue to be used to link all current Access layer switches on campus.
- Existing Firewalls shall remain in the old server room until such time a plan is made to the the WAN links to the new server room
- Installation and configuration of Layer 3 switches have to comply to and support the following Technologies:
 - Fully manageable switching
 - Gigabit switching
 - Policy based switching
 - Power over Ethernet
 - Spanning tree
 - Stack ability
 - V-LAN Capability
 - Quality of Service (QoS)

- Software Defined Networking (SDN)
- Highly available hardware architecture
- IPv4/IPv6 support
- Full layer 3 routing support
- Routing Protocols such as OSPF, RIP and BGP support
- Multicast support
- Advanced layer 2 loop avoidance technologies
- Layer 2 virtual routing and forwarding(VRFs)

- V-LAN Design and Configuration

In the event that the Tendered deems the current IP structure inadequate for optimal traffic routing, the following VLAN guidelines shall apply;

Contractor will ensure that VLANs are designed and configured based on geographic locations and functional areas as follow:

- VLAN for each department
- VLAN for servers
- VLAN for all network devices for management functions
- VLAN for Wireless Guest users
- VLAN for Voice traffic (VOIP)
- VLAN for Video data

- Wireless Network Installation and Configuration

Wireless (Wi-Fi) solution should be installed to meet the following requirements:

- Each Access Point must have standard settings and configurations for the service
- Each Access Point must self-mitigate signal interference
- Suitable power supply, lightning protection are required subject to the site
- Access Points must be automatically upgraded to the appropriate software revision on initial connection
- Access Points must be deployable on the same LAN/VLAN/IP subnet as the

controller, or on different LANs/VLANs/IP networks separated by routers/WAN links where appropriate

- Access Points must have at least two Ethernet ports allowing the cascading of multiple access points, or the connection of Ethernet based devices should such a need arise
- If the APs implement any proprietary or non-802.11 standards based MAC protocol manipulation, the contractor should explain and indicate any potential interoperability caveats or limitations.

1.7 Supply, Installation, Labelling & Testing of Structured ICT network Cabling

See **Annexure B** for detailed ICT network Cabling Infrastructure Specification

- New server room at Media Centre will be linked to existing server room using Fibre optic uplinks
- Wellness Centre will be linked with a fibre uplink to the new server room at Media Centre
- Media Centre first floor cabinet will be linked to new server room via fibre uplink
- Installation of LAN UTP/ Fibre cabling must conform to the following:

43 U Floor Standing Cabinet will be placed in the new server room

- Floor Standing Cabinets shall conform to the following standards:
 - i) Have an Aluminium frame.
 - ii) Dimensions 43U (H) x 600mm (W) x 800 mm or 1000 mm (D)
 - iii) Fitted with four punched profiles and four depth reducers. For heavily loaded Cabinets, the depth reducers may be increased.
 - iv) Fitted with a set of four adjustable metal feet (50mm in diameter and 75mm height)
 - v) Fitted with blank floor plates.
 - vi) Fitted with four high performance ball bearing low noise fans fitted in a tray at the top of the cabinet. The fans shall expel air from the cabinet.
 - vii) Fitted with a tinted safety flexi glass door and three lockable metal doors. All doors shall be removable without the use of tools. All doors

15 U Wall Mounted Swing Cabinets will be placed in Media Centre (first floor) and Wellness Centre

- A Wall Mounted Cabinet will conform to the following standards:
 - i) Shall be of the swing frame type.
 - ii) Shall be reversible.
 - iii) Shall have a weight carrying support between the cabinet housing and the frame to ensure that the cabinet lock does not carry any weight in the locked position.
 - iv) Dimensions 15U (H) x 600mm (W) x 400mm (D)
 - v) Fitted with a set of two punched profiles
 - vi) Fitted with two high performance ball bearing low noise fans fitted on the sides of the cabinet. One fan shall expel air from the cabinet and the other impels air into the cabinet.
 - vii) Fitted with a lockable tinted safety flexi glass door. The frame and the door shall be lockable with the same key. Two keys shall be supplied for each cabinet.
 - viii) The colour of the cabinet will be determined in the URS. The cabinet shall be powder coated.
 - ix) Shall be fitted with a 5 Way metal power duct with a circuit breaker.
 - x) Shall have cable entries at the bottom and top of the wall box.
- The bidder must provide LAN Cable Installation in accordance with IEEE 802.3 to support TCP/IP, IPX and OSI protocols like Ethernet, Fast Ethernet and Gigabit Ethernet
- Cat6 UTP cables and Multimode/Singlemode fiber (Depending on distance) optic cables
- All Fiber-Trays should be provided
- Supplier must ensure that Ethernet products comply with the IEEE 802.3z standard and inter-operate with any other product

1.8 Supply, Installation & Configuration of Server Infrastructure

See **Annexure C** for detailed Server Infrastructure Specification.

- The following must be taken into consideration during this phase of the project:
 - Tenderer must ensure that all server infrastructure devices are installed in their dedicated server rack
 - All servers will be installed in the new server room at Media Centre
 - The new servers will be virtualized using an adequate virtualization platform
 - Virtualization of the current physical server to the virtual platform (clean installation)
 - Moving of the current information to the virtual platform
 - Tenderer to ensure that all hosts are virtualised by using a reputable hypervisor

AS-BUILT DRAWINGS

The appointed contractor is to prepare the As- Built paper prints in strict accordance with this specification. These drawings are to be kept at the site office.

MAKING GOOD

The appointed contractor will be responsible for making good in all trades of any damage to buildings or other services that he or his employees may have incurred during the construction of the works.

The appointed contractor will be responsible for keeping the site clean and tidy and shall remove from the site all rubble and litter resulting from his works on site.

WORDING

The word "approve" means approval by the Consulting Engineer.

SUPERVISION

A qualified and experienced representative of the appointed contractor, with a proven track record, shall supervise all work carried out.

The representative must be authorized by the appointed contractor and must be able to receive instructions on behalf of the contractor.

DATA CENTRE PERIPHERALS

A 43 U server rack must be installed in the new server room at the Media Centre. The features of the server cabinet should include the following Features:

- Includes fixed shelf & fan kit
- Max loading: 60kg
- Quick open side doors for easy install and maintenance
- RU markings printed on both front & rear mounting rails
- Back entry, Top and bottom wire path
- Wall installation type
- Lockable via keys
- Gloss black colour
- Easy clean surface
- Venting on front and sides

REGULATORY, QUALITY STANDARDS

- (a) All **Protocol standards:** The bidder must ensure compliance to the following LAN / WAN protocol standards:
- IT10101 Internet Protocol (IP) v4 and
 - IT10102 Transmission Control Protocol (TCP).
- (b) The Supplier must for the duration of the contract ensure compliance with <IEC/ISO Environmental conditions
- (c) The Supplier must for the duration of the contract ensure compliance with <IEC/ISO Manufacturing and Workmanship quality condition.
- (d) The Supplier must for the duration of the contract ensure compliance with <ISO/IEC General Quality Standards, ISO9001

CERTIFICATION, EXPERTISE AND QUALIFICATION

- (a) The Supplier confirms that:
- (i) it can perform all obligations detailed herein without any or by means of very limited interruption to the Customer;
 - (ii) it has the necessary expertise, skill, qualifications and ability to undertake the work required in terms of the special conditions of this bidder's specification, and;
 - (iii) it is committed to provide the products and services set out in this bidder specifications.
- (b) The Supplier must provide the service in a good and workmanlike manner and in accordance with
- the practices and high professional standards used in well-managed operations performing services similar to the services specified herein;
- (b) The Supplier must perform the Services in the most cost-effective manner consistent with the level of quality and performance as defined in terms of the special conditions of this bidder's specification.

CABLES

In cases where there is no provision of electrical power outlets, the appointed contractor shall lay electrical cables according to the following guidelines. However, recommendations from an onsite electrical contractor shall always take precedence over the below guidelines

1.9 General

The appointed contractor is to supply and install all the low voltage cables specified in this document along the routes shown on the drawings and according to the sizes shown on the single line diagrams and/or as specified.

The cables must comply with the requirements as set out in the specification documents of the electrical cables installation. Bare hard drawn copper earth continuity conductors are to run with all four core underground cables constituting part of the low voltage distribution system. The earth conductors must be bound to the cables at intervals not exceeding 1 meter with cable ties.

For clean earth connections to computer equipment a green PVC insulated single core cable shall be used, which shall be bonded to the main board earth bar and to the clean earth bar of the computer distribution board, and to no other earthed material.

Conductor insulation which is colour coded by a line only, will not be accepted. The total insulation must have the phase colour.

1.10 Installation

a) Testing

All low voltage cables must be tested on site, in the presence of the Consulting Engineer. All test results must be submitted to the Consulting Engineer.

On each completed section of the laid cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 1000 V for low voltage cables.

b) Depth of Trenches

All low voltage cables must be installed 600mm to the top of the cable, below ground level.

c) Marking Tape

Yellow PVC marking tape, 150 mm wide must be supplied and installed 300mm below the final surface and directly above all cables. The wording "Electric Cable" must be provided on the marking tape.

d) Cable Lengths

Tenderers must base their tender price on the preliminary lengths specified in the Bill of Quantities. After installation the exact lengths shall be determined on site. Adjustments to the contract price shall then be calculated using the rates in the Bill of Quantities.

Cables are **not to be ordered** according to lengths measured in the Bill of Quantities. It shall be the responsibility of the electrical contractor to establish the correct lengths of cable required on site including lengths required for termination of cables, before placing an order. The electrical contractor shall not be reimbursed for any surplus cable.

1.11 Cable Trenches

Tenderers must base their rates for cable trenches in soil, soft rock and hard rock on the quantities given in the Bill of Quantities. The actual quantities shall be determined on site. Adjustments to the Contract Price shall be calculated using the rates in the Bills of Quantities, after completion of the installation.

No guarantee can be given that explosives will not be necessary for excavations. However,

should explosives be necessary and the contractor receive permission to use explosives, the electrical contractor shall remain responsible for all work done with the explosives and shall comply with all conditions, regulations, requirements etc. imposed by the governing bodies.

Should excavations be done in close proximity of existing services extreme care must be exercised. Only labourers with experience of these conditions may be utilised.

The bottom and sides of trenches must be of smooth contour, and shall have no sharp dips or rises that may cause tensile forces in the cable during backfilling.

Backfilling of trenches may commence only after the trenches have been approved and shall be compacted in layers of 150 mm. Sufficient allowance must be made for final settlement. For the first layer of 150 mm, soil sifted to remove all hard objects of 15mm mesh or larger and of which 75 mm must be below and 75 mm must be above the cable must be used. Where no suitable soil is available on site, the contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of soil importation must be included in the appropriate rate for excavations.

The electrical contractor shall be responsible to take the necessary precautions where excavations may be dangerous. Refer to the Occupational Health & Safety Act (Act 85 of 1993), Reg. 11 of the Construction Regulations. The electrical contractor must ensure that all buildings, sewer, etc., are protected against collapsing soil conditions.

The cable trenches shall be excavated to width of 300mm wide for one to three cables and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run.

Payment will be made on the tendered rates based the specified dimensions or the actual dimensions whichever is the lesser. The only exception shall be in cases of additional excavations caused by obstructions such as water pipes, drains, large rocks, etc., in which case the magnitude of the additional excavation must be agreed upon on site by the Consulting Engineer.

1.12 Joints

Joints in cable runs shall not be allowed unless specified or authorised in writing by the Consulting Engineer. Where cable joints are to be made, a joint hole must be excavated of sufficient size to enable the cable jointer to work efficiently and unimpeded.

Each cable end must be left in a loop of 0,9 m to prevent any tension on the joint.

During backfilling the section supporting the joint must be compacted to the extent that no

Where cables are cut and not immediately made off, the ends are to be sealed without delay.

1.13 Cable laying

Cables must be removed from the drums in such a manner that the cable is not subjected to mechanical damage, twisting or tension exceeding that stipulated by the cable manufacturer.

The laying of cables shall not commence until the trenches have been inspected and approved. The cables must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to the approval of the Consulting Engineer after drawing in of the cables.

1.14 Sleeves

All sleeves indicated on the drawings are to be supplied and installed by the contractor.

Electrical cable sleeves and **communication** sleeves must be installed at least 600mm apart. All crossings of these sleeves must be at 90° with the communication sleeves on top.

Before backfilling, the ends of all sleeves must be sealed with paper and a weak cement mixture.

1.15 Cable Markers

All labeling shall be printed permanent ink PVC labels. All printed labels shall be black on white with a font size of at least 8 mm.

Labeling shall be done as follows:

Patch Panels: A, B, C etc: from the top to bottom of the cabinet. The label will be on the left side of the Patch Panel.

Wall Outlet: **GAA01** where:

G – Floor on which the cabinet is situated.

A – Cabinet number

B – Patch Panel Number

01 – Port on Patch Panel

The cable will be labeled with the same number at the back of the Patch Panel and at the back of the wall outlet no more than 50mm from the termination. Cable markers must be provided on all cable runs at 50 m intervals on straight runs and at all bends. The position of

cable markers must be confirmed on site.

Cable markers must consist of 150mm x 150mm x 300mm high concrete blocks with aluminium or other corrosion proof metal plates marked with arrows to indicate the route.

The cable markers must protrude 25mm above ground level.

One cable marker must be placed at the site boundary where the Fibre sleeve enters the site.

ANNEXURE A

SPECIFICATION FOR (LAN) NETWORK INFRASTRUCTURE

NETWORK INFRASTRUCTURE
Description
Network Switch: Stackable 48x1G PoE+ ports; 4x 10G fixed uplinks ports;
Network Switch: 24 10/100/1000 PoE+ ports and 2 SFP+ module
3M Type 3 Stacking Cable - for C2900L-48P-4G
10 GBASE-SR SFP Module
Access Point: Dual-band, controller-based 802.11a/g/n/ac, configurable Indoor environments, with internal antennas

Wireless Access Point specification
Access Points (APs)must concurrently support:
The legacy 802.11a, 802.11b and 802.11g standards
The 802.11n standard in both the 2.4 and in the 5 GHz bands
The 802.11ac standard in the 5Ghz band
APs must support 220+ concurrent client devices of a mixed nature.
APs must support 4 MIMO streams (4x4:4 specification)
APs must support WPA2 Personal/Enterprise authentication and AES/CCMP encryption.
APs must be capable of being powered by standard 802.11af PoE with no loss of functionality in the 5GHz radio

APs must be Wi-Fi Alliance certified and support the standards: WMM, WMM-PS, 802.11d, 802.11h and 802.11e.
The AP must support LACP (link aggregation) across Ethernet ports
Polarization Diversity with Maximal Ratio Combining (PD-MRC)
Maximum Likelihood Decoding (MLD)
Low Density Parity Check (LDPC)
Space Time Block Coding (STBC)
Packet Aggregation
APs must support 802.1q VLAN tagging and tagging of each WLAN individually

ANNEXURE B

ICT Network Cabling Infrastructure Specification

- UTP Cable standard will be CAT6
- Fibre: Multimode
- The supplier must ensure that all cabling services comply with ISO/IEC 11801:2002 / Amd 2:2010 Information technology - Generic cabling for customer premises.
- The bidder must provide LAN Cable Installation in accordance with IEEE 802.3 to support TCP/IP, IPX and OSI protocols like Ethernet, Fast Ethernet and Gigabit Ethernet
- Cat6 UTP cables and Multimode/Singlemode fiber (Depending on distance) optic cables
- All Fiber-Trays should be provided
- Supplier must ensure that Ethernet products comply with the IEEE 802.3z standard and inter-operate with any other product
-
- Proposed Patch-Lead colour utilisation:

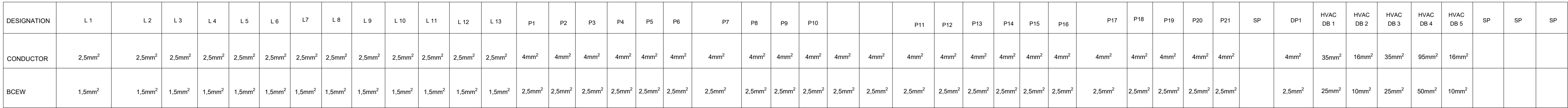
Cable Use	Cable Colour
Normal Data	Grey
1m Patchleads (server room)	Yellow
3m Patchleads (office)	Grey
Server patchleads	Blue

ANNEXURE C

Server Infrastructure Specification.

Host Server Spec	
Form factor	2- 4U
Processor	2 X 3.0 GHz (16 core minimum) 155W
Operating System	Windows server 2016
Memory	128 GB
Front drive bays	2 X 256 GB SSD, 6 X 1 TB HDD
Data Protection	TPM 1.2/2.0 optional Cryptographically signed firmware, Secure Boot, System Lockdown, Secure erase
Raid	10
Power	<ul style="list-style-type: none">•Platinum 1100W X 2• Hot plug power supplies with full redundancy option 8 hot plugs fans with full redundancy
Network Card	4x 1Gb
Front ports	Video, 2 x USB 3.0, dedicated iDRAC Direct USB
Rear ports	Video, serial, 2 x USB 3.0, dedicated iDRAC network port
Video card	VGA, Up to 13 x Gen3 slots, (3 x8 + 10 x16)
RAID Controllers	Internal controllers: PERC S140, H330, H730P, H740P Boot optimized Storage Subsystem External HBAs (RAID): H840
Virtual platform	VMWare

*****End of Document*****



Project						
<h1> EKURHULENI EAST TVET COLLEGE </h1>						
Title						
<h2> DB-W (Wellness Centre) SINGLE LINE DIAGRAM </h2>						
Designed	Drawn	Checked	Appr.	Scale	Size	Date
SN	SN	TM	DM	NTS	A1	18-07-21
Project Number		Division	Service	Drawing Number		Revision
1082		E	P	1082-E-101		C

