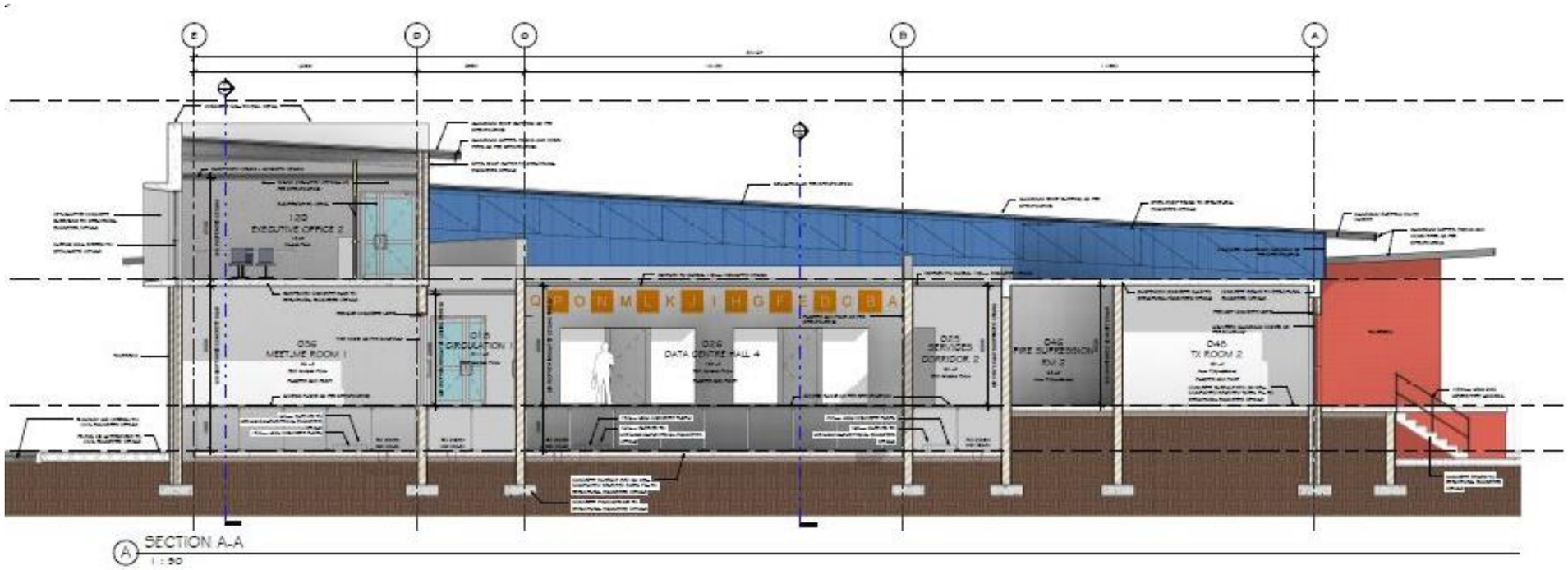
Data Centre
ELIDZ Zone1A

CONTRACT NO.: ES/DATA/02/20/Z1A

DESIGN SPECIFICATIONS & CRITERIA



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1 CARTOON SECTION

A ARCHITECTURAL

S STRUCTURAL

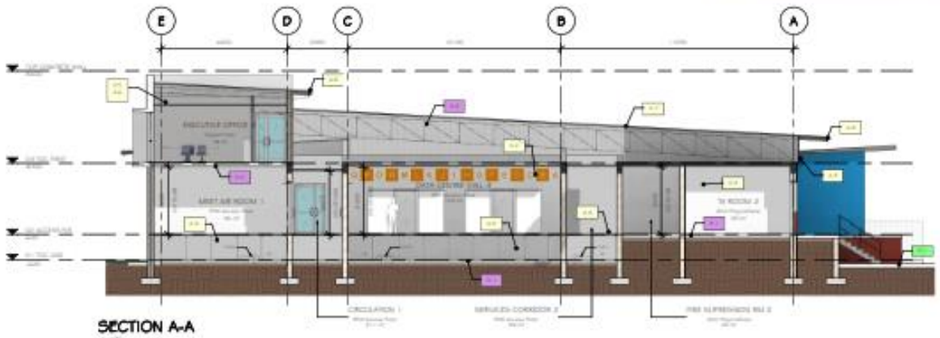
C CIVIL

M MECHANICAL AND FIRE

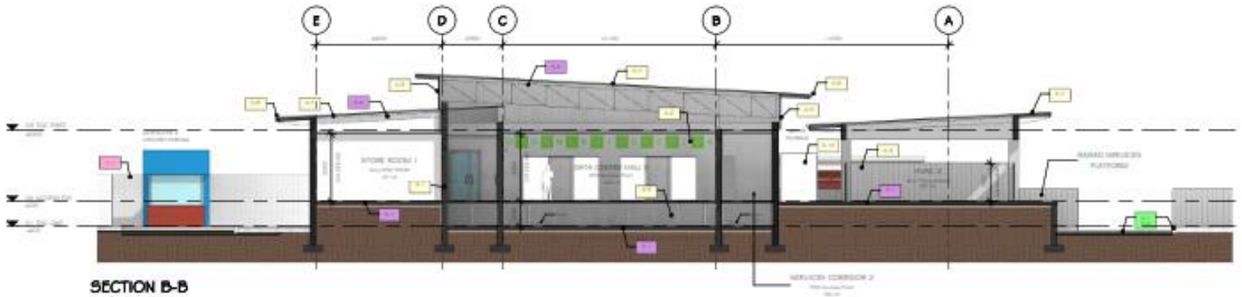
E ELECTRICAL

T TELECOMMUNICATIONS

G GENERAL



SECTION A-A



SECTION B-B

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
2 GENERAL INFORMATION (REFER TO ABOVE CARTOON SECTION)		
2.1 Architectural Notes		
2.1.1 A.1: Openings in Envelope - Roller Shutter doors Receiving Area: 2500mm (w) x 2500mm (h) Approved Industrial 45mm thick vertical lift sectional door. Aluminium sections infilled with polyurethane foam, stucco-textured inside and outside with uniform horizontal ribbing. Electrically operated with motor as supplied by manufacturer. Neoprene top weather strip for full width of door, neoprene bulb weather strip with continuous retainer full width of bottom of door. Dual replaceable seals between sections. Door opening will be formed in brickwork with precast concrete lintels to top of opening, reveals plastered and painted. Door to be protected by concrete filled bollards placed internally and externally on either side of the door opening.		A C E L M S
2.1.2 A.2: Openings in Envelope - Windows No external openings will be made for windows in Data Centre Halls. Windows in office accommodation to be powder coated aluminium in accordance with Sans 1578 parts 1 and 2. HBS Advantage curtain wall pressure glazing system built into brick walling/concrete frame. System to meet requirements of AAAMSA performance and design loading of SANS 10160.		A C E L M S
2.1.3 A.3: Data Centre Halls, Meet-Me Rooms and Support Rooms - CLASSIFICATION – D4 External walls will be 280mm cavity clay brick on strip foundations to engineer's detail. External finish with one coat wood floated plaster suitably prepared for painting with two coats Plascon Micatex. Internal finish with one coat wood floated plaster suitably prepared for painting with two coats Plascon "Wall n All" in light tint colour. Internal walls will be formed using 230mm clay brick walls with all exposed surfaces finished with one coat wood floated plaster skimmed with Plascon Skim Coat PSI-1, primed and suitably prepared for painting with two coats Plascon "Wall n All" in light tint colour. Concrete surface beds generally 35/19Mpa 150mm thick to carry a load of 500kg/m^2. Raised access flooring 1200mm above surface beds to be Bergvik 600x600 ESD Iso Floor with uniform distributed load of 20kN/m^2. Surface bed, plinths and walls below access floor to be suitably prepared for painting with two coats Plascon Wall and All. Concrete plinth 150mm high to be provided around all 160mm service sleeves. Two No. Green Drain waterless self-sealing trap type floor drains to be provided in surface bed per room. Skirtings to be 19x69mm Hollow backed meranti skirting with arris rounded top edge, with 19mm Meranti quadrant to skirting base, suitably prepared for painting with two coats Plascon Velvaglo. 3200mm High ceilings will be 100mm Isophen FM Global Polyphen or equal and approved Insulated ceiling panels, Class 1 fire rated supported on proprietary ceiling grid system including aluminium angle as cornice to side walls all to Engineer approvals. Note cut-outs required for all fittings and ceiling services. Ceiling panels to be constructed such that they can be walked on in order to install all services. Internal doors to be standard internal quality 2hr fire rated hinged doors in suitable 1.6mm gauge double rebated galvanized steel frame and fire rated doorset. Doors to be suitably prepared for painting with two coats Plascon Velvaglo. All doors to be installed with electromagnetic locking devices and linked to fire and access control system. All in compliance with SABS 1253: 2016 for appropriate fire rating. External doors to be standard external quality 2hr fire rated hinged doors with viewing panels in suitable 1.6mm gauge double rebated galvanized steel frame and fire rated doorset. Doors to be suitably prepared for painting with two coats Plascon Velvaglo. All doors to be installed with electromagnetic locking devices and linked to fire and access control system. All in compliance with SABS 1253 : 2016 for appropriate fire rating. No external openings will be made for windows in Data Centre Halls. 600x600 Painted wall markings on wall 100mm below ceiling level, to align with access floor panels/grid system. Numbering reference as per section detail. Room name painted on wall adjacent to entrance door and on internal wall positioned opposite entrance door.		A C E L M S
2.1.4 A.4: Utility Rooms - CLASSIFICATION – D4 / Generator & Diesel Storage - CLASSIFICATION J1A.2: Openings in Envelope - Windows External walls will be 280mm cavity clay brick on strip foundations to engineer's detail. External finish 1020mm high facebrick plinth with facebrick above. Facebrick plinth - Makana Brick 43MPa Heritage Travertine FBX burnt clay masonry unit, size 222x106x73mm, manufactured in accordance with 227:2007, bedded and jointed in Class II mortar and pointed with flush vertical and recessed horizontal joints, suitable for exposure to zones 1-4. Facebrick - Makana Brick 43MPa Heritage Travertine FBX burnt clay masonry unit, size 222x106x73mm, manufactured in accordance with 227:2007, bedded and jointed in Class II mortar and pointed with recessed vertical and recessed horizontal joints, suitable for exposure to zones 1-4. Internal walls will be formed using 230mm clay brick walls with all exposed surfaces finished with one coat wood floated plaster suitably prepared for painting with two coats Plascon "Wall and All" in light tint colour. Surface beds generally 35/19Mpa 150mm thick, reinforced mesh ref 395, 35MPa power floated concrete, primed with Sikafloor 161 and finished with 4mm Sika Polyurethane finish. 3230mm High suspended concrete roof slab with perimeter beams all to Structural Engineer's specification. Soffit prepared for painting with two coats Plascon Wall and All. Doors will be purpose made powder coated fully louvered aluminium doors in accordance with Sans 1578 parts 1 and 2. HBS Nuklip system built into brick walling. System to meet requirements of AAAMSA performance and design loading of SANS 10160. Louvres will be purpose made powder coated aluminium louvres in accordance with Sans 1578 parts 1 and 2. Louvre and filter type to Mechanical Engineer's specification.		A C E L M S

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Fencing around HVAC equipment will be 1800mm high Clearview pressed high density mesh panel with aperture size 76.2 x 50mm. Mesh and posts got dip galvanised with coastal fusion bond finish, complete with 10-year underwritten guarantee all to manufacturers detailed instructions. System to be installed bolted to floor with proprietary system and posts and panels to be secured together using manufacturer's approved system.		
2.1.5 A.5: Offices and Ablutions – Single Storey – CLASSIFICATION - G1 External walls will be 280mm cavity brick on strip foundations to engineer's detail. External finish 1020mm high facebrick plinth with facebrick above. Facebrick plinth - Makana Brick 43MPa Heritage Travertine FBX burnt clay masonry unit, size 222x106x73mm, manufactured in accordance with 227:2007, bedded and jointed in Class II mortar and pointed with flush vertical and recessed horizontal joints, suitable for exposure to zones 1-4. Facebrick - Makana Brick 43MPa Heritage Travertine FBX burnt clay masonry unit, size 222x106x73mm, manufactured in accordance with 227:2007, bedded and jointed in Class II mortar and pointed with recessed vertical and recessed horizontal joints, suitable for exposure to zones 1-4 Internal walls will be formed using 230/110mm clay brick walls with all exposed surfaces finished with one coat wood floated plaster skimmed with Plascon Skim Coat PSI-1, primed and suitably prepared for painting with two coats Plascon "Wall n All" in light tint colour. Concrete walls to be off-shutter concrete CLASS 2 board marked textured finish. Refer to Engineer's details and specifications Internal partition walls in general office areas will be constructed using Gyproc Gypwall Classic 63/F30S42 system, prepared for painting using Plascon "Wall n All" in light tint colour. Internal sound insulated partition walls to meeting rooms and Executive Offices will be constructed using Gyproc Gypwall Firestop 63/F60 system using Cavitybatt, prepared for painting using Plascon Wall and All. Partitions walls higher than 3250mm to be built using 102mm studs with 60min fire rating and 52dB sound rating. Wall stud sizes and centres to be as set out by Gyproc Isover detailed instructions. Skirtings to brick walls will be 19x69mm Hollow backed meranti skirting with arris rounded top edge, with 19mm Meranti quadrant to skirting base, suitably prepared for painting with two coats Plascon Velvaglo. Skirtings to partition walls will be standard 70mm high natural anodised aluminium Concrete surface beds generally 30/19MPa 100mm thick with mesh 245 reinforcement, to carry a load of 500kg/m2. Floor finishes; Reception & circulation areas: Porcelain tiles Offices : Heavy Commercial grade Belgotex Berberpoint 920 carpet tiles. Toilets or tea kitchens : Porcelain tiles Storerooms : 2mm Marley Supaflex vinyl sheet in "base range" colours. Staging Area : 2mm FloorworX SD directional static dissipative vinyl sheeting, manufactured in accordance with EN 649 and laid over an earthed grid of aluminium tape in FloorworX No.27 conductive acrylic adhesive which has been spread using a trowel fitted with an A2 notched blade at a rate of between 5.5m^2 and 6.5m^2 per litre on a previously prepared Class 1 sub-floor in accordance with SANS 10070, using FloorworX Self Leveller when required Toilet and wet areas will be tiled with ceramic wall tiles to architects detail to ceiling height. Ceilings to office accommodation will be 600 x 600mm suspended acoustic ceiling tiles laid in exposed aluminium T-grid. The ceiling height will be 2720mm above floor level and have a ceiling void of a minimum of clear 450mm depth above. 9mm Gypsum bulkheads along junctions with ceiling and suspended slabs at stairs and walkways. Escape stair concrete roof slab primed with abe bitu-prime, abe Index VIS P 3mm torch-on applied to all 90° junctions as gussets and finished with abe Index Unigum Biarmato MS torch-on, all in accordance with the manufacturer's instructions. Escape stair concrete roof slab and concrete stair soffits to be prepared for painting with two coats Plascon Wall and All. Ceilings to ablutions will be 600 x 600mm suspended vinyl clad gypsum ceiling tiles laid in exposed aluminium T-grid. The ceiling height will be 2720mm above floor level and have a ceiling void of a minimum of clear 450mm depth above. Internal service room doors to be flush panel 2400 x 813mm solid core doors with concealed edges finished with primer and two coats Plascon Velvaglo. Internal doors to ablutions and tea kitchens to be purpose made 2400x900mm powder coated aluminium doors with 6.38mm Intruderprufe NS clear laminated safety glass with white opaque vinyl film. Internal doors to offices and meeting rooms to be purpose made 2400x900mm powder coated aluminium doors and 1500mm wide sidelight, with 6.76mm Acoustic clear laminated safety glass with vinyl film pattern.		A C E L M S
2.1.6 A.6: Offices and Ablutions - Double Storey– CLASSIFICATION - G1 Suspended reinforced concrete slab on load bearing brickwork designed for: Occupancy load = 300 Kg/m^2 Partition load = 200 Kg/m^2 Office accommodation and ablution ceilings as for single storey offices.		A C E L M S
2.1.7 A.7: Roof Sheeting and Insulation Huletts Aluminium 'Global Roofing Solutions' 0,9mm thick Ziptech 420 Profile aluminium roof sheeting and accessories with stucco embossed mill finish, concealed fixed through insulation to galvanised cold rolled purlins with insulation tape between purlin and roof sheet, with 'Ziptech' Aluminium Halters fixed with stainless steel screws. Installation region: from 0m to 400m of the coast – C5 High Corrosion Risk. All in strict accordance with the manufacturer's instructions. Isover 75mm Factorylite insulation laid over purlins in single lengths and supported on galvanised straining wires at 300mm centres. Solar hot water system and Photovoltaic panel system to be fixed to Ziptech roof sheets using 'Global Roofing Solutions' approved aluminium structural clamps		A C E L M S

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Eaves to be closed with inverted sheeting and fixed to underside GMS purlins to Structural Engineer's details. Sheeting to be Huletts Aluminium 'Global Roofing Solutions' 0,8mm thick BR7 Profile stucco embossed mill finish, . All in accordance with the manufacturer's instructions.		
2.1.8 A.8: Gutters and Downpipes 150x150x0.9mm Aluminium gutter with stucco embossed mill finish, fixed with aluminium gutter brackets at max 500mm cntrs, gutter edge fixed to roof sheeting with 25mm wide aluminium gutter straps, all in accordance with manufacturer's instructions. 100x75x0.9mm Aluminium down pipes with stucco embossed mill finish, fixed to brickwork with 25mm wide aluminium gutter straps. Downpipes fixed to gutter conical rainwater outlet. Downpipes at 6m intervals. Fullbore outlets & gravity drainage used for exposed concrete roof slabs.		A C E L M S
2.1.9 A.9: Side Cladding Huletts Aluminium 'Global Roofing Solutions' 0,8mm thick BR7 Profile embossed aluminium vertical cladding with Azure Blue Color-Tech G4 finish, from 4000mm above finished floor level to eaves level, fixed to galvanised cold rolled girts with insulation tape between girt and cladding with stainless steel screws. Bottom edge of side cladding to eastern and western facades to be angled, fixed to girts fixed onto brickwork. Installation region: from 0m to 400m of the coast – C5 High Corrosion Risk. All in accordance with the manufacturer's instructions. No side wall insulation is provided.		A C E L M S
2.1.10 A.10: Rainwater Harvesting Provide 8 x 5000l vertical water tanks, placed above ground on raised platform along northern façade. Tanks to be interconnected and include suitable submersible pump for connecting to landscaping/irrigation/grey water flushing system.		A C E L M S
2.1.11 A.11 Perimeter Fencing Fencing around SITE will be 2400mm high Clearview pressed high density mesh panel with 600mm high electrification above fence. Panel aperture size 76.2 x 50mm. 400mm Wide concrete mowing edge along fence. One 5000mm wide automated sliding gate positioned at site entrance. One 900mm wide pedestrian gate with access control positioned at site entrance for visitor access. Fencing around Visitors Parking and Utility Area will be 1800mm high Clearview pressed high density mesh panel. Panel aperture size 76.2 x 50mm. 400mm Wide concrete mowing edge along fence. One 4500mm wide automated sliding gate positioned at Utility Area. Mesh and posts got dip galvanised with coastal fusion bond finish, complete with 10-year underwritten guarantee all to manufacturers detailed instructions. System to be installed with proprietary system and posts and panels to be secured together using manufacturer's approved system.		A C E L M S
2.2 Structural Notes		
2.2.1 S.1: Concrete Surface Beds GATE HOUSE AND OFFICES Concrete to be 30/19MPa, 100mm thick with mesh ref. 245 DATA CENTER AND ELECTRICAL, HVAC, UPS ROOMS Concrete to be 35/19Mpa with washed sand, 150mm thick jointed with fibre reinforcing "fibrin 900g/m³".(Mesh 395 only if required by client) Construction and Saw-cut joints to be max 4m x 4m panels, length to width ratios of the panels not to exceed 1.25. Levelness and flatness specification to be SABS 1200 class II. Damp proofing membrane 250 micron to be installed under surface beds on 20mm sand bedding. Minimum layer works below all floors: • 150mm layer G5 compacted to 95%Mod Aashto @ OMC • 150mm layer G7 compacted to 95%Mod Aashto at OMC		A C E L M S
2.2.2 S.2: Structure – Columns/Beams First floor offices to be constructed with reinforced concrete columns / beams framed structure with brick infill panels. Design imposed loading: First floor Offices for general use: 2.5kPa Reinforced pad footings with R.C. stub columns Reinforced strip footings		A C E L M S
2.2.3 S.3: Roof Structure The roof structure consists of Parallel chord trusses (3º) spaced at 6.115m centres, minimum depth 1000mm. Parallel chord lattice trusses at various spans, max 12.5m. Shorter spans over offices and HVAC to have steel rafters. Services load is 40kg/m^2 with 20kg/m^2 reserved for standard mechanical and electrical services and 20kg/m^2 available for tenant services, Plus additional 20kg/m^2 for PV panels. Main support columns, reinforced concrete. Gable Columns: reinforced concrete. All steel hot dipped galvanised.		A C E L M S
2.2.4 S.4: Canopies		A

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2500mm wide cantilevered structural steel canopy will be provided above Receiving Area roller shutter door.		C	
		E	
		L	
		M	
		S	
2.2.5 S.5: Staircases Staircases to upper levels of offices are reinforced concrete. Galvanised mild steel internal staircases will be used to provide access to mechanical equipment above Data Centre Hall ceiling level.		A	
		C	
		E	
		L	
		M	
		S	
2.3 Civil Notes			
2.3.1 C.1: External Hard Standing External hardstands will consist of 200mm thick, Unreinforced 30MPa/38mm concrete on two layers of imported G5 type material. Jointing of concrete surfaces will be designed by the Engineer and will consist of sealed saw cut joints and sealed construction joints. Construction joints will be fitted with 115 x 115 x 6mm galvanised steel plates. Saw cut joints to be min 6mm width with an effective cut of 1/3 the depth of the hard stand surface, cut in a two-cut process. Construction joints to be min 6mm effective width fitted with a backing strip and sealant. Joint sealant to be specified and approved by the ELIDZ, joint sealant to be silicone free. Saw cut panels to have maximum dimensions of 4.5m x 4.5m. Expansion joints against building edges or structures. Finishes of hardstand areas will be to a mechanical float "Pan Finish" texture. Curing of hardstand surface will be via an approved curing compound acceptable to the design Engineer. Hardstands will be cast to falls away from buildings to drainage collectors such as kerb inlets along roads edge with underground concrete storm water pipes class 100D, sized to take a 1 in 5-year flood event. Heavier rain will result in surface water drainage across the site to site entrances and onto external roads. Were collection of storm water cannot be achieved along the road/hardstand edge, drop inlet structures with heavy duty grill covers are to be positioned at the required design intervals and trapezoidal shaping of hardstands designed to achieve drainage to falls not exceeding 1:20 to the drop inlets must be constructed. Where there is evidence of sub-surface ground water on site, A sub soil drainage system must be designed by the engineer. Office and visitor parking area – will consist of 200mm thick Unreinforced 30MPa/38mm concrete on two layers of imported G5 type material. The same as specified above. Traffic manoeuvring models are to be verified and reported on to the ELIDZ, and to the requirements of the tenant.		A	
		C	
		E	
		L	
		M	
		S	
2.3.2 C.2: Kerbing and Access Ramps Hardstand edges finished with 180mm high precast Fig.3 type barrier kerbs set on 15MPa concrete haunching. Space from building to back of kerb is finished with bond paved sidewalks of varying widths with lawns or planted areas in between. Pavers will consist of 80mm interlocking pavers colour to architect's specification on a 2 x 150mm G5 type base. Access Ramps with vehicle traffic will consist of 200mm thick, Unreinforced 30MPa/38mm concrete on two layers of imported G5 type material. The access ramps to have a 1:13 slope between hardstand and finished floor level with 10mm weather step. Access ramps for pedestrian use only will consist of 100mm thick, unreinforced 25MPa/19mm concrete on a 150mm subbase layer of G7 type material with a 150mm base layer of G5 type material. Concrete panels via saw cuts at 2.5m max.		A	
		C	
		E	
		L	
		M	
		S	
2.3.3 C.3: Access to Sewage and Water Reticulation Municipal services are provided along the road reserve. The site is serviced with a sewer and water connection point. The underground sewers servicing the building must be provided to accommodate all the internal plumbing outlets. The minimum diameter and class are 110mm uPVC Class 34 solid wall pipe. Water supply mains provide 20kl per day per hectare of erf area with a max head of 90m and a min of 25m. Separate metered connections to each building must be provided. A separate external fire main must be provided to supply the fire hydrants for the building.		A	
		C	
		E	
		L	
		M	
		S	
2.4 Mechanical Notes			
2.4.1 M.1: Air-conditioning M1.1 Offices Air-conditioning shall be a VRV type system (Daikin or similar approved). M1.2 Data Centre Halls / Meet-Me Rooms Air-conditioning shall be a chilled water system with internal variable speed control air-handling cabinets (CRAC Units), with dual redundancy allowance, including leak sensors, temperature and humidity control and monitoring, high efficiency filtration, high energy efficiency, set point stability, rotation / back-up / auxiliary functions between cabinets and the entire air-conditioning system shall meet the requirements of a Tier III Classification. M1.3 Utility Rooms Air-conditioning shall be a chilled water system or a DX system with internal variable speed control air-handling cabinets, with dual redundancy allowance, including temperature and humidity control and monitoring, high efficiency filtration, high energy efficiency, set point stability, rotation / back-up / auxiliary functions between cabinets and the entire air-conditioning system shall meet the requirements of a Tier III Classification.		A	
		C	
		E	
		L	
		M	
		S	

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M1.4 General It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility. External condenser units shall have a secondary corrosion resistant protection coating (Blu-chem or similar approved). All air-conditioning units shall be provided with wired type controls and shall be integrated into a BMS system and shall meet the requirements of a Tier III Classification.		
2.4.2 M.2 Fire Protection M2.1 General The site and building are to be designed and constructed in accordance with the National Building Regulations SANS 10400 "Part T". The building is to be divided (fire divisions, etc.) in such a manner so as it does not need a sprinkler installation. Data Centre Halls and Meet-Me Rooms are to be 120 minute fire rated rooms, therefore any penetrations are to be fire proofed accordingly, by using correct passive fire protection methods (fire stops, fire dampers, etc.) in accordance with relevant SANS Standards (SANS 10400 / SANS10177). It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility. M2.2 Fire Reticulation System Single metered connection to each site / Tenant, separating into domestic and firefighting (fire appliance) systems. The fire fighting main is to be connected to a dual booster connection (accessible to the Fire Brigade at the site entrance) with external fire hydrants, including a connection to the building for the internal fire appliance reticulation, as required. M2.3 Fire Appliances Internal fire hydrants, fire hose reels and fire extinguishers are to be provided for a Building Occupancy: • Offices - G1 • Data Centre Halls - D4 • Utility Rooms - D4 • Generator and Diesel Storage - D4 / J1 Additional fire appliance requirements for process areas to be catered for by the Tenant. M2.4 Fire Detection An analogue addressable fire detection system (Category L1) is to be provided within the facility in accordance with SANS 10139. The fire detection system shall meet the requirements of a Tier III Classification. M2.5 Fire Suppression: Data Centre Halls / Utility Rooms / Meet-Me Room An environmentally friendly 3 zone conventional fire suppression system (Category L1), for the total flooding within the respective rooms (fire suppression nozzles are to be placed within the room, hot aisles and within the floor voids), is to be provided in accordance with SANS 10139, SANS 246, SANS 369 and SANS 14520 as required. It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility.		A C E L M S
2.4.3 M.3: Ventilation Ventilation in building will be provided in terms of the stipulated minimums in SANS 10400 "Part O" and the OHS Act under the Environmental Regulations for Workplaces. Air extraction systems will be provided for ablution facilities, canteens and tea kitchens in accordance with SANS 10400 "Part O". Fresh air will be provided for all air-conditioned spaces in accordance with SANS 10400 "Part O". Room areas are to be less than 500m^2 to eliminate the need for smoke extraction, according to SANS 10400 "Part T".		A C E L M S
2.5 Electrical Notes		
2.5.1 E.1: Design Criteria and Parameters The design criteria applied to the electrical engineering services shall include the following, namely: ❑ Capital costs ❑ Operational and maintenance requirements and costs ❑ Ease of functionality, operation and maintenance ❑ Compliance with general energy efficiency and / or sustainability standards Furthermore, the electrical engineering services shall be designed in accordance with, but not limited to, the current versions of the following, namely:		A C E L M S

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❑ the South African National Standard : Code of Practice for "The Application of the National Building Regulations" i.e. those included in the "National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977)", as published in the Government Gazette, number 31084, dated 30 May 2008, which became effective as of 01 October 2008, and known as "SANS 10400 - 2010" ❑ the Occupational Health and Safety Act, 1993 (Act 85 of 1993), ❑ SANS 204-1 : 2008 - Energy Efficiency in Buildings : Part 1 - General Requirements, ❑ SANS 204-2 : 2008 - Energy Efficiency in Buildings : Part 2 - The Application of the Energy Efficiency Requirements for Buildings with Natural Environmental Control, ❑ SANS 204-3 : 2008 - Energy Efficiency in Buildings : Part 3 - The Application of the Energy Efficiency Requirements for Buildings with Artificial Ventilation or Air-conditioning, ❑ any other relevant by-laws of the Local Authorities, ❑ SANS 507-1 : (NRS 034-1 : 2007) Electricity Distribution - Guidelines for the Provision of Electricity Distribution Networks in Residential Areas (Part 1 : Planning and Design of Distribution Networks) ❑ SANS 10114-1 : 2005 : Interior Lighting ❑ South African National Standard : SANS 10142-1: 2003 - The Wiring of Premises : Part 1 - Low-voltage Installations ❑ "SANS 0313 - 1999 : The Code of Practice for "The Protection of Structures against Lightning" SANS 10139 : 2007 - Edition 3.1 - "Fire Detection and Alarm Installations for Buildings - System Design, Installation and Servicing", as amended		
2.5.2 E.2: Accreditation / Classification It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility.		A C E L M S
2.5.3 E.3: Bulk Electricity Service Connection It is anticipated that the Data Centre shall eventually require an 11 000 V, dual, redundant, ring-fed, 2.0 MVA bulk electricity service connection. Although the medium voltage reticulation within the East London Industrial Development Zone has sufficient spare capacity to accommodate this project, an application shall still be submitted to the East London Industrial Development Zone for the necessary bulk electricity service connection, for record purposes. The East London Industrial Development Zone shall not impose any electricity service connection fees and / or electricity account deposits on the project. The project shall be responsible for the necessary medium voltage reticulation (2 off 11kV cables installed in a ground trench) between the Data Centre and the existing medium voltage substation, known as "SS 1A4". The Client / Employer, under a separate contract, shall extend the existing 11 kV switchboard within the "SS 1A4" medium voltage substation and prepare same to accept the medium voltage reticulation installed by the project, en route from the Data Centre. The 11kV switchboard shall be equipped with two 11kV circuit breaker type feeder circuits for the purposes of providing the bulk electricity service connection to the Data Centre. These circuit breakers shall be equipped with all necessary metering and protection facilities as is required by the Client / Employer. As is required by the desired Tier Certification and Accreditation, the Data Centre shall be serviced by means of a bulk electricity service connection which has a dual, redundant and ring-fed capacity and configuration. Therefore, the medium voltage reticulation, as explained above, shall enter the Data Complex site at two differing positions, en route to the respective on-site medium voltage substations and provide an interconnection between the respective substations. It is envisaged that the Data Complex shall be serviced by two off medium voltage substations, which shall be termed "Substation A" and "Substation B". These respective substations shall comprise separate medium voltage and transformer rooms. The afore-mentioned anticipated bulk electricity service connection, and associated bulk electrical equipment, has been determined as follows: ❑ Electrical load drawn by data and associated equipment 1080 kW 1350 kVA ❑ Electrical load to be serviced by UPS system 1296 kW 1620 kVA ❑ Electrical load to be serviced by generator system 1555 kW 1944 kVA ❑ Size of transformer (as detailed below) 2000 kVA However, in an effort to reduce the initial construction cost, the Client / Employer has indicated that the initial electrical demand may be deemed as follows: ❑ Electrical load drawn by data and associated equipment 360 kW 450 kVA ❑ Electrical load to be serviced by UPS system 432 kW 540 kVA ❑ Electrical load to be serviced by generator system 520 kW 648 kVA ❑ Size of transformer (as detailed below) 600 kVA This project specification is based on the assumption that the anticipated bulk electricity service connection is to be provided. The Contractor is to construct the Data Centre, and all its utility rooms, as if the anticipated bulk electricity service connection is to be provided, but the Contractor is to equip the Data Centre with the bulk electrical equipment necessary for the initial (reduced) electrical demand. It is of utmost importance that the Contractor constructs the Data Centre facility in such a manner that the provided bulk electrical equipment can easily and practically be upgraded / replaced with the equipment necessary for the anticipated electrical demand, without any subsequent builder's Works. Wherever possible, the bulk electrical equipment may be reduced in size and capacity, but the general characteristics and specifications thereof must remain as detailed herein.		A C E L M S

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It is anticipated that the initial electrical demand can be serviced by means of 11 kV / 420 V / 630 kVA miniature substations. Thus, reducing the necessity of medium voltage switchgear and medium voltage transformers. The Contractor is to consider this option and to prepare an alternative proposal on the basis thereof.		
2.5.4 E.4: Medium Voltage Switchgear The medium voltage switchgear shall comprise the following, namely: ❑ Substation A, housing a four panel 11kV switchboard (with one "incomer" panel, one "interconnection feeder circuit en route to Substation B" panel, one "transformer feeder" panel and one "voltage transformer" panel) ❑ Substation B, housing a four panel 11kV switchboard (with one "incomer" panel, one "interconnection feeder circuit en route to Substation A" panel, one "transformer feeder" panel and one "voltage transformer" panel) ❑ All medium voltage equipment fed, and inter-connected, by a dual, redundant and ring-fed medium voltage cable network		A C E L M S
2.5.5 E.5: Medium Voltage Transformers The medium voltage transformers shall comprise the following, namely: ❑ Transformer A, SANS 780, 11 kV / 420 V, 2000 kVA, Dyn11, Copper ❑ Transformer B, SANS 780, 11 kV / 420 V, 2000 kVA, Dyn11, Copper ❑ Transformers A and B will be connected to the same medium and low voltage network, with possible interconnection and therefore, are to be identical w.r.t. physical and electrical characteristics.		A C E L M S
2.5.6 E.6: Medium Voltage Cables All single core and three core cables with stranded copper conductors and insulated with cross linked polyethylene, shall comply with SANS 1339. Conductors shall comprise standard annealed copper, complying with the requirements for class 2 conductors in SANS 1411-1. All single core cables shall comply with the requirements given in tables 11, 12 and 13 of SANS 1339:1981. All three core cables shall comply with the requirements given in tables 23, 25 and 26 of SANS 1339:1981 for type A cable and tables 29, 31, 32 and 33 for type B cables.		A C E L M S
2.5.7 E.7: Low Voltage Reticulation The low voltage reticulation shall comprise the following, namely: ❑ Main Low Voltage Panel, termed MLVP A, housed within LV Room A ❑ Main Low Voltage Panel, termed MLVP B, housed within LV Room B ❑ A series of electrical distribution boards throughout the Data Centre (note: all electrical distribution boards and associated low voltage cables necessary for the User's internal electrical installation shall be provided under this contract) ❑ All main low voltage panels and respective electrical distribution bards shall be inter-connected by a low voltage cable network Electricity feeder cables shall be Cu PVC PVC SWA ECC PVC cables, with stranded conductors. All main low voltage panels and electrical distribution boards are to be manufactured by a reputable company, with relevant experience in the manufacturing of low voltage panels, electrical distribution boards, control panels, etc.		A C E L M S
2.5.8 E.8: Builder's and related Works, Trench Excavations, Brick-built Enclosures (Manholes), Ducts The Contractor shall be responsible for the necessary co-ordination and timing of the builder's and related Works pertaining to this Contract. All Utility Rooms shall be constructed with the necessary floor trenches for the installation of all associated electrical services. The Contractor shall undertake all trench excavations, including backfilling and compaction, required for the electrical installation. The Contractor shall be responsible for the provision of the brick-built enclosures (manholes). The Contractor shall be responsible for the provision of all ducts necessary for the electrical and, telecommunications and associated installations. In summary, ducts shall be installed beneath (across) all walkways, driveways, and finished surfaces. The ducts shall be manufactured from a high-density polyethylene with a double wall construction, allowing a corrugated outer wall finish and a smooth inner wall finish, and of the internal diameters as indicated on the attached drawings. All ducts shall be minimum 160mm outer diameter, with minimum 137mm internal diameter.		A C E L M S
2.5.9 E.9: Generator The Contractor shall provide an open set-type, diesel-driven generator set, complete with automatic mains failure facilities, controller, change-over and protection switchgear, base-mounted fuel tank and GSM (global system for monitoring via mobile phones) alarm system.		A C E L M S
2.5.10 E.10: Uninterruptible Power Supply Unit The Contractor shall provide a highly efficient, scalable, three phase power protection unit with flexible operating modes suitable for Data Centre facilities, as manufactured by Schneider Electric. The unit provided shall, as a minimum, meet the specification of the Schneider Electric 500 kW to 1500 kW, Galaxy VX product range.		A C E L M S
2.5.11 E.11: Conduit and Conduit Accessories All flush-mounted conduit and conduit accessories shall be PVC conduit in accordance with SANS 950. All surface-mounted conduit and conduit accessories shall be galvanised conduit type, and manufactured in accordance with SANS 162, 763 and 1007 respectively.		A C E

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All exposed conduit and conduit accessories shall be galvanised, powder coated, orange.		L M S
2.5.12 E.12: Conductors All low voltage single core conductors shall be of the PVC insulated type with stranded copper conductors, rated at 600 V general service duty and manufactured in accordance with SANS 1507 - 1990.		A C E L M S
2.5.13 E.13: Lighting Installation A lighting installation, in accordance with the relevant regulations, which will ensure the efficient and proper usage of all spaces throughout the new buildings, shall be provided. All luminaires specified shall be fitted with light emitting diode-type lamps. The lighting design calculations shall be based on achieving the minimum lighting levels, in accordance with the relevant South African National Standards documentation, as follows: ❑ Manufacturing - General Working Areas (*) - 350 lux ❑ Administrative Buildings - Entrance Halls - 100 lux ❑ - Reception Areas - 100 lux ❑ - Board rooms, offices - 300 lux ❑ - Computer rooms - 500 lux ❑ Maintenance Buildings - General - 300 lux The lighting design shall (where applicable) take into account and include the following, namely: ❑ Specified luminaires shall provide high levels of luminous flux and be fitted with electronic control gear ❑ Specified lamps shall provide the correct colour rendering for the application and use energy efficient lamps i.e. light emitting diode (LED) type ❑ Maximum natural daylight usage and controllable light levels ❑ Task specific light sources ❑ Multiple control for light circuits / zones covering areas greater than 100 m² Emergency exit signage and route lighting shall be provided for any evacuation procedures that could occur. Allowances shall be made for decorative post-top type luminaires, with light emitting diode type lamps, on fibreglass poles to be installed throughout the complex including along all walkways, roadways and parking areas. The luminaires shall comply with the specification detailed in the Project Specification. All low voltage single core conductors shall be of the PVC insulated type with stranded copper conductors, rated at 600 V general service duty and manufactured in accordance with SANS 1507 - 1990.		A C E L M S
2.5.14 E.14: Small and Large Power Generally, power shall be provided to the various areas by means of switched socket outlets. The layout and quantity of the switched socket outlets shall be determined by the use of the specific room, the equipment to be installed therein and the services / activities to be rendered from there. Switched socket outlets shall be provided approximately every 10m² in all passages and public areas for cleaning and maintenance purposes. Should the activity or specific equipment require, i.e. within the kitchen areas, the power supply provided shall be in the form of a switched isolator. As the design responsibility ends at the switched socket outlet or isolator points, we cannot guarantee what the End User is going to connect to the installation. Therefore, it is only possible to encourage (and not guarantee) energy savings at switched socket outlet and isolator points.All low voltage single core conductors shall be of the PVC insulated type with stranded copper conductors, rated at 600 V general service duty and manufactured in accordance with SANS 1507 - 1990.		A C E L M S
2.5.15 E.15: Power Skirting Installation / Flush-floor or Under-screed Ducting Installation The power skirting, where applicable, shall be O-Line Premier Skirt PM2, a fully modular system, manufactured from self-extinguishing polycarbonate, with a white finish white in colour, complete with all necessary accessories, corner pieces, covers, dividers, elbows, end caps, joint clips, outlet clips, tee pieces, etc. Where applicable, the flush-floor ducting and under-screed ducting systems shall be fully modular, manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut.		A C E L M S
2.5.16 E.16: Cable Support Systems Cable Ladder Where applicable, the cable ladder shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. The cable ladder shall be of a weld-free construction, allowing fitment on site. No alternatives shall be accepted. Cable Tray Where applicable, the cable tray shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. The cable tray shall be of an inward bend return flange construction, allowing the use of thinner gauge materials, without compromising loading or deflection standards. No alternatives shall be accepted. General All exposed cable support systems shall be powder coated, orange.		A C E L M S
2.5.17 E.17: Wiring Duct Installation / Wiring Mesh Installation Where applicable, the wiring duct shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line.		A C

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Where applicable, the wiring mesh shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. All exposed wiring duct / wiring mesh shall be powder coated, orange.		E L M S
2.5.18 E.17: Wiring Duct Installation / Wiring Mesh Installation **E.18 Earthing (Bonding), Specialist Earthing, Surge Protection and Lightning Protection Systems** *Earthing (Bonding) System* The Contractor shall be responsible for the supply and installation of the required earthing (bonding) system. *Specialist Earthing* The Contractor shall be responsible for the supply and installation of the specialist earthing system. The earth resistance of the respective earth bars, earth mats and earth star systems shall not exceed 30 ohms and shall be supplemented as necessary with driven molecular bonded copper clad steel rods manufactured to SANS 0163 - 1985. Separate earth mats / systems shall be provided for the following facilities / areas, (where applicable), namely: ❑ Substations, Medium Voltage Switch Rooms, Transformer Rooms, Low Voltage Switch Rooms, Generator Installations ❑ Uninterruptible Power Supply Installations, etc. ❑ Telecommunications / Data Server Rooms / Data Centre Halls *Surge Protection System* The Contractor shall be responsible for the supply and installation of the required surge protection equipment. All low voltage panels and electrical distribution boards are to be fitted with surge protection, as is required by the relevant regulations. *Lightning Protection System* The Contractor shall be responsible for the supply and installation of the required lightning protection system, protecting all buildings within the Data Centre. The lightning protection system shall be installed in accordance with the relevant South African National Standards documentation and shall comprise (per building): ❑ An air termination system installed on all parapet walls / exposed elements ❑ A down-conductor system installed within wall cavities, or surface mounted, whichever is necessary ❑ A down-conductor bonded to earth termination system ❑ Ground earth electrodes ❑ An earth termination system		A C E L M S
2.5.19 E.19: Staff Training The Contractor shall provide comprehensive training of male and female operational staff and nominated maintenance personnel, to the approval of the Client / Employer. Training shall be comprehensive, covering all aspects of systems installed as part of these Works.		A C E L M S
2.6 Telecommunication Notes		
2.6.1 F.1: Electric Fence The Contractor shall provide a security compliant perimeter electrified fence. The fence shall be monitored and shall comprise of the following: ❑ 3000mm high perimeter security fence ❑ Configured into expandable zones ❑ Galvanised tensioners on both ends ❑ Instant reporting alarm conditions ❑ Stainless steel slider poles ❑ 29 strand fence wire in the "earth and live" method ❑ Stainless steel straining wire		A C E L M S
2.6.2 F.2: Access Control – Biometrics / Locking Devices The access control and locking devices system shall be installed in accordance with the relevant South African National Standards documentation and shall comprise (per lockable door) ❑ Installed biometric readers ❑ Magnetic locking or fail to safe locking devices to be installed ❑ Connection via relay to fire detection system in case of emergency ❑ Fully monitored devices for recording of entry and exit of staff member and visitors		A C E L M S
2.6.3 F.3: Access Control – Booms The Contractor shall allow for the complete installation of all conduits, outlet boxes, plinths, booms, loops, etc., required for the access boom control system namely. ❑ Install Auto-Gate red and white, powder coated full 316 stainless steel chassis booms ❑ Install red and white reflective barrier arms ❑ Ensure harmonic lifting on all operational booms ❑ Install presence and exiting loops for each boom ❑ Install control panel in the guardhouse with lock out ❑ Removable key lockout		A C E L M S

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2.6.4 F.4: Security Intruder Alarm The Contractor shall allow for the complete installation of all conduits, outlet boxes, passives, control panels, wiring, power supply units etc., required for the intruder alarm system namely. ❑ Door monitored statuses to be reported from the magnetic devices on each external door ❑ Self-activated (pet & rodent friendly) passives for the monitoring of each room ❑ Capable of connecting to offsite monitoring ❑ Give the user ability to arm and disarm via wireless and a fixed keypad station ❑ Ensure GSM capabilities for client monitoring		A C E L M S
2.6.5 F.5: Closed Circuit Television The Contractor shall allow for the complete installation of all conduits, outlet boxes, IP cameras, recorders, switches, etc., required for the closed circuit television system and be capable of the following: ❑ 24 hour scheduled recording and event logging ❑ Installation of Internet protocol cameras ❑ Installed unmanaged switches with power over Ethernet in wall mounted cabinet ❑ Client viewing from any mobile device ❑ NVR based recording system ❑ Lockable cabinet with tinted glass ❑ Minimum of 2 by 4 TB Hard drives to be installed		A C E L M S
2.6.6 F.6: Data Network and IP Telephone System The Contractor shall allow for the complete installation of all conduits, outlet boxes, data/telephone points, recorders, switches, PABX, etc., required for the private and closed internet protocol network and have the following capabilities and characteristics: ❑ Run at 1 Gig high speed network or above ❑ Flush mounted cat6e connection points at all points ❑ Internet protocol telephone handsets to be user friendly ❑ Cabinet mounted unmanaged 24 port 1 gig switches ❑ Colour coded fly-leads to be installed at all brush panels ❑ Black cabinet mounted brush panels to be installed		A C E L M S
2.7 General Notes		
2.7.1 G.1: Landscaping ELIDZ will provide site landscaping.		A C E L M S
2.7.2 G.2: Inclusions The following services, unless otherwise stated or agreed, will be provided by the landlord: ❑ Standby diesel generators ❑ UPS equipment ❑ Surge Protection ❑ Internal computer network cabling ❑ Computer access flooring ❑ Internal PABX and telephone networks ❑ Electricity reticulation from the internal site electricity network to tenant's plant components ❑ Internal division walls within Data Centre ❑ Gas suppression ❑ Floor drains ❑ Bulk storage tanks – Rainwater Harvesting ❑ AC and ventilation plant. ❑ Fire suppression system and general fire protection. ❑ Building, operational and tenant signage. ❑ Special security systems and access control. ❑ Electrified perimeter fence and automated sliding gates.		A C E L M S
2.7.3 G.3: Exclusions The following services, unless otherwise stated or agreed, are not provided by the landlord: ❑ Furniture, fixtures and fittings. ❑ Computers. ❑ Tea Kitchen equipment. ❑ Lockers. ❑ Special foundations for tenant's equipment. ❑ Compressor rooms. ❑ Compressed air supply and equipment. ❑ Forklift refuelling enclosures. ❑ Water supply, effluent control and other under floor wet services to process areas. ❑ Steam generation. ❑ Logistics equipment. ❑ Dock levellers.		A C E L M S

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❑ Specialised lifting equipment and crawler beams. ❑ Power factor correction equipment.		
3 DESIGN SPECIFICATION– EXTERNAL ROADS AND HARDSTAND		
3.1 Site Entrances		
3.1.1 General All works to shall be in accordance with the latest SANS 1200 Specifications. Concrete Hardstand will consist of 200mm Unreinforced 30MPa/38mm concrete hardstands on two layers of imported G5 type material. Concrete for hardstands shall be placed only on approval of a recognised mix design that has proven strength results. Mix design and material sampling from ready mix suppliers shall be verified and confirmed. Slumps and on-site cube sampling of concrete shall be required as part of the approved QMS, in batch sizes approved by the Engineer. Approved curing methods are to be implemented. Jointing of concrete surfaces will be designed by the Engineer and will consist of sealed saw cut joints and sealed construction joints. Construction joints will be fitted with 115 x 115 x 6mm galvanised steel plates. Saw cut joints to be min 6mm width with an effective cut of 1/3 the depth of the hard stand surface, cut in a two-cut process. Construction joints to be min 8mm effective, fitted with a backing strip and sealant. Joint sealant to be specified and approved by the ELIDZ, joint sealant to be silicone free. Saw cut panels to have max dimensions of 4.5m x 4.5m Mesh 395, to be placed in all irregular formed panels, round protrusions and as directed by the Engineer. Shear bar design as per the Engineer. Finishes of hardstand areas will be to a mechanical float "Pan Finish" texture. Curing of hardstand surface will be with an approved curing compound acceptable to the design Engineer.		A C E L M S
3.1.2 Entrance gates Concrete hardstand as per specification as stated in item 4.1.1 above.		A C E L M S
3.2 On Site Parking		
3.2.1 Vehicle Parking All staff vehicles must be accommodated on SITE no offsite parking is allowed. Concrete hardstand as per specification as stated in item 4.1.1 above.		A C E L M S
3.3 Loading Requirements		
3.3.1 Loading and Unloading space requirements Traffic manoeuvring models are to be verified and reported on to the ELIDZ, and to the requirements of the tenant. Design Vehicles are as per the ASSTHO Geometric Design guidelines and are listed below: • SU-10 Truck (10tonner) • Passenger Car		A C . E L M S
3.3.2 Access to the Street Refer to: • ELIDZ Design Guideline (Aug 2004, Rev 3) • ELIDZ Development Guideline (March 2011, Draft 24)		A C E L M S
3.4 Kerbing		
3.4.1 Junction between building & external hard stand Junctions between building and hardstands will be designed by the Architect. The surface will be as per the Architects specification either paving or unreinforced concrete. Pavers will consist of 80mm interlocking pavers colour to specification on a 2 x 150mm G5 type base. Unreinforced concrete will be 200mm thick on a 2 x 150mm G5 type base. Edging of the area "Apron" will be fig 3 type precast Barrier kerb set on 15Mpa/19 haunching. Jointing of concrete panels via saw cuts 2.5m max. 10mm Expansion jointing between Brick and adjacent concrete surface to be installed and joint sealed. Apron to be cast to fall away from building.		A C E L M S
3.4.2 Building entrances on sidewalk Where entrances may be required these would have a **1:13 slope** between hard stand and finished floor level with **10mm step weather sill** aligned with inner face of door. Step formed using a galvanised steel angle set into concrete.		A C E L M S

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3.4.3 Joint between building & hard stand 10mm Expansion jointing between Building brickwork and adjacent concrete surface to be installed and joint sealed.		A	
		C	
		E	
		L	
		M	
		S	
3.5 External Hardstand			
3.5.1 Hardstand surface drains Hardstands will be cast to falls away from buildings to drainage collectors along roads edge. Were collection of storm water cannot be achieved along road edge drop inlet structures are to be positioned and trapezoidal shaping of hardstands designed to achieve drainage. Minor storms 1: 5y return period will be piped via concrete storm water pipes of class 100D minimum rating spigot socket type. Major storm 1:20y and greater will spill over onto road surfaces, flooding areas to be checked by Engineer, and reported and will be contained on hardstand areas along site boundaries. All manhole accesses in hardstand areas are to be of Heavy-Duty type SANS 558, Type 2A, "Modified "to be cast integrally with Hard Stand Concrete. External hardstands are to be shaped and graded to allow uniform drainage to catch pits and storm water inlets along road edges. Surface drains with heavy duty grill covers generally located at 24m centres to underground storm water pipes, will be located in open hardstand areas with dished drainage, where uniform flow cannot be achieved and drainage is required in open areas.		A	
		C	
		E	
		L	
		M	
		S	
3.5.2 Surface drains pipe sizes Storm water pipes sized to take 1:5-year storm event. Heavier rain will result in surface water drainage to entrances and onto external roads. Pipe sizes will be as per the manufacturer's specification, and will be limited to class 100D spigot and socketed type concrete pipes. Major storm events are to be determined by the Engineer and if found that an overflow of storm water could endanger or pose risk to adjacent property adequate sizing of the storm water installation must be made to prevent this.		A	
		C	
		E	
		L	
		M	
		S	
3.5.3 Size of trucks and frequency for unloading Truck sizing and frequency of unloading must be confirmed with the Architect and all traffic manoeuvring simulations must be checked and reported on to the tenant and ELIDZ. Design Vehicles are as per the ASSTHO Geometric Design guidelines and are listed below: • SU-10 Truck (10ton) • Passenger Car		A	
		C	
		E	
		L	
		M	
		S	
3.5.4 Size of trucks and frequency for dispatch Truck sizing and frequency of unloading must be confirmed with the Architect and all traffic manoeuvring simulations must be checked and reported on to the tenant and ELIDZ.		A	
		C	
		E	
		L	
		M	
		S	
3.5.5 Hardstand thickness, finish & slope. Generally, 200 mm thick, unreinforced 30 MPa surface bed. The Engineer to design check on the pavement against vehicle loadings and design traffic. Finishes of hardstand areas will be to a mechanical float "Pan Finish" texture. Hardstands will be cast to falls away from buildings to drainage collectors along roads edge. Were collection of storm water cannot be achieved along road edge drop inlet structures are to be positioned and trapezoidal shaping of hardstands designed to achieve drainage with falls not exceeding 1:20.		A	
		C	.
		E	
		L	
		M	
		S	
3.5.6 Hardstand joints Jointing of concrete hardstands will be designed by the Engineer and will consist of sealed saw cut joints and sealed construction joints. Construction joints will be fitted with 115 x 115 x 6mm galvanised steel plates. Saw cut joints to be min 6mm width with an effective cut of 1/3 the depth of the hard stand surface, cut in a two-cut process. Construction joints to be min 8mm effective width fitted with a backing strip and sealant. Joint sealant to be specified and approved by the ELIDZ, joint sealant to be silicone free. Saw cut panels to have max dimensions of 4.5m x 4.5m.		A	
		C	
		E	
		L	
		M	
		S	
3.5.7 Service Trenches Service trenches will comply to the specifications of the SANS 1200, DB, L, LB, LC, LD, LE and will be made safe in accordance the guidance of the OHS specifications. Classification of materials will be done in accordance the SANS 1200 DB, or particular specification as drawn up by the design Engineer.		A	
		C	
		E	
		L	
		M	
		S	
3.5.8 Platform Platforming activities will be conducted in accordance the SANS 1200 D. The cut to fill of the platform must be optimised with available cut materials.		A	
		C	
		E	

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All spoil must be taken off site to an approved spoil site. Imported fill material must comply to a minimum spec of G7 type quality material.		L	
		M	
		S	
3.6 Traffic Signage and Road Markings			
3.6.1 Traffic signage and road markings To latest SARTSM.		A	
		C	
		E	
		L	
		M	
		S	
3.7 Sleeves Required			
3.7.1 All Buildings Sleeves are to be of a min 110mm diameter of approved type HDPE material, fitted with couplings, end caps draw wires and parking's as directed by the local authority. Sleeves are to be positioned in depth and quantity as per the site requirements a client needs, minimum depth 1.2mm. Junction boxes and termination ends are to be marked as per the local authority requirements. Kerb markings and plaques are to be erected on road and hardstand crossings.		A	
		C	
		E	
		L	
		M	
		S	
4 DESIGN SPECIFICATION – STRUCTURAL			
4.1 Concrete Foundations			
4.1.1 General All earthworks required for the foundations shall be in accordance with the latest SANS 1200 D Specifications. All concrete work shall be designed in accordance with SANS 10100-1 & 2 and carried out strictly in accordance with SANS 1200 G. All foundations and bases to be minimum 25 MPa / 19mm Reinforced Concrete at 28 days.			
4.1.2 Data Centre Halls, Meet-Me Rooms and Support Rooms Foundations will consist of conventional base designed by a Structural Engineer. Perimeter walls will be 330mm reinforced concrete cavity filled retaining walls designed by a Structural Engineer. Concrete for foundations shall be placed only on approval of a recognised mix design that has proven strength results. Mix design and material sampling from ready mix suppliers shall be verified and confirmed. Slumps and on-site cube sampling of concrete shall be required as part of the approved QMS, in batch sizes approved by the Engineer. Approved curing methods are to be implemented.		A	
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4.1.3 Offices and Buildings Pad and strip foundations to be cast Monolithically in order to allow for reinforcement tie in. Pad and strip foundations to be cast Monolithically in order to allow for reinforcement tie in. All concrete shall be placed on a layer of blinding concrete, not exceeding 50mm, 15MPa/19. Concrete will either be reinforced strip footings or conventional base and ground beam construction.		A	
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4.2 Structural Concrete – Columns, Beams & Floor slabs			
4.2.1 General All concrete work shall be designed in accordance with SANS 10100-1 & 2 and carried out strictly in accordance with SANS 1200G. All structural concrete elements to be minimum 30 MPa / 19mm Reinforced Concrete at 28 days.			
4.2.2 Data Centre Halls, Meet-Me Rooms and Support Rooms Reinforced concrete columns along the internal and external perimeter walls. Reinforced concrete beam above door height along external perimeter walls.		A	
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4.2.3 Utility Rooms Reinforced concrete columns along the external perimeter walls. Reinforced concrete beam above door height along external perimeter walls. Reinforced concrete suspended floor slab at ceiling height.		A	
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4.2.4 Offices and Ablutions Reinforced concrete columns along the internal and external perimeter walls. Reinforced concrete beam above door height along external perimeter walls. Reinforced concrete suspended floor slab at first floor height.		A	
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ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
		S
4.3 Structural Steel – Roof Structure		
4.3.1 General All structural steelwork shall be designed in accordance with SANS 10162-1 and fabricated and erected in accordance with SANS 1200 H (Structural steelwork) and SANS 10162 (Structural use of Steel)		
4.3.2 Data Centre Halls, Meet-Me Rooms and Support Rooms The roof structure consists of Parallel chord trusses (3º) spaced at 6,115m centres, minimum depth 1000mm. Parallel chord lattice trusses at various spans, max 12,5m. Shorter spans over offices and HVAC to have steel rafters. Services load is 40 kg/m2 with 20 kg/m2 reserved for standard mechanical and electrical services and 20 kg/m2 available for tenant services, Plus additional 20 kg/m2 for PV panels. Main support columns, reinforced concrete. Gable Columns: reinforced concrete. All steel hot dipped galvanised.		A C E L M S
4.3.3 Offices As stated above. The roof structure consists of steel rafters.		A C E L M S
4.4 Structural Steel – Galvanising: Hot Dip Galvanizing		

4.4.1 General
• The hot dip galvanized coatings shall conform in every respect to the standards contained in the South African National Standards, SANS 121 (ISO 1461) Hot dip galvanizing coatings on fabricated iron and steel articles and SANS 32 (EN 10240) Internal and/or external protective coatings for steel tubes, Hot Dip Galvanizing specification for products other than continuously galvanized sheet and wire as well as the SANS1200HC or latest edition of the relevant specification.
• All pre-hot dip galvanized sheeting shall be minimum grade Z275 to SANS 4998:2007 Continuous hot dip zinc coated carbon steel sheet or structural quality and all wire to SANS 675:2009: Specification for coated fencing wire.
• The galvanizer shall be an accredited member of the Hot Dip Galvanizers Association Southern Africa (HDGASA) and shall issue a certificate of conformance to ISO 10474 or if registered as a South African Bureau of Standards (SABS) Mark Scheme Galvanizer, a SABS certificate of conformance. (A list of approved members is available on the Association web site, www.hdgasa.org.za.
• All structural steel shall be minimum grade of S355JR (350WA) and shall be certified with a Silicon content between 0.15% and 0.23% and Phosphorus content <0.02%. The contractor to supply the certificate as proof of the above requirements prior to the manufacturing of any structures.
• For this project all steelworks shall not be hot dip galvanized U.N.O. on drawings.
• It is the contractor's responsibility to ensure that all steel to be hot dip galvanized shall be designed and fabricated in accordance with ISO 14713: 2011 Part 1: General principles of Hot dip Galvanizing and ISO 14713: 2011 Part 2: - Design for hot dip galvanizing.
• The hot dip galvanizer shall provide a quality management plan detailing inspection procedures, which will include inspection of steel prior to galvanizing, inline inspection during surface preparation and galvanizing and final inspection prior to dispatch. Where fabrication defects are identified prior to galvanizing, e.g. burrs, poor welding or excessive weld spatter, such components shall be placed on hold and a non-conformance report submitted to the fabricator.
• Double end dipping shall be permitted provided that it will not result in distortion of the product and an acceptable surface finish of the coating is achieved.
• Bolts and nuts of gr 4.8 and gr 8.8 shall be hot dip galvanized to SANS 121 (ISO 1461) and high tensile fasteners from grade 10.9 and above, shall be hot dip galvanized in conformance to ISO 10684. The hot dip galvanizer shall issue a certificate of compliance with this requirement. All fasteners shall be supplied by a SABS approved manufacturer.
• Zinc electroplated (electro-galvanizing) bolts and nuts are unacceptable.
• All welds to be full length seal weld.
• Any coating repairs undertaken on the galvanizers premises or later on site, e.g. touch up of small-uncoated surfaces (black spots), shall be strictly limited both in dimension and quantity as stipulated in the relevant SANS 121 (ISO 1461) specification.
  ○ Uncoated areas and defects shall be repaired according to the site repair instructions below of this. The repaired surface shall not be accepted or dispatched until the repaired surface coating has cured.
  ○ Where coating defects exceed the specified permissible limit, which qualifies for touch-up repairs after galvanizing, affected items shall be rejected and re-galvanized or, if applicable, a repair method may be approved in writing by the engineer.
  ○ Final inspection: Following satisfactory completion of the final inspection and provided prior arrangements have been made as per clause 1, the galvanizers' inspectorate shall issue a certificate stating that the applied coating conforms to the requirements of SANS 121 (ISO 1461) or SANS 32 (EN 10240) as applicable.		

4.4.2 Quality surveillance • For the purpose of carrying out quality surveillance, the engineer or its QA / QC Consultant shall be granted access to any part of the galvanizer's premises relevant to the work being carried out, at any reasonable time. The galvanizer shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.		A C E L

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
• The Engineer may remove any reasonable samples of materials to be used in the coating application. Rejection of the sample will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material. • The Engineer may carry out reasonable destructive tests to ascertain compliance with the specification. The contractor, to the satisfaction of The Engineer and at no additional cost, shall repair areas thus damaged. • The cost of quality surveillance will be borne by the Engineer, except where surveillance results in rejection of the work or when notice by the contractor results in a fruitless trip, in which case the contractor shall carry the cost of surveillance.		M S
4.4.3 Handling and storage • Handling: All coated components shall be handled using soft slings or specially positioned lifting points provided for such handling. • Loading and off-loading: All hot dip galvanized and/or duplex coated components to be transported shall be loaded on suitable dunnage and lashed to avoid chafing and steel to steel contact. Plastic "Spaghetti strips" must be used to protect smaller items of steel and angles (5mm spaghetti plastic coil). Coated steel shall be secured on the truck preferably with nylon securing straps. Where chains must be used, suitable rubber insertion pads must be placed between the coated steel and chains at all contact points. • Cover: Coated items shall be stored under cover where possible. Items not stored under cover shall be stored in such a manner as to avoid retention of water and allow good circulation. Items shall be stored on timber or on trestles fitted with timber to raise the product to at least 100mm off the ground. • Stacking: Items shall be stacked using timber packaging or other approved means to avoid coating-to-coating contact. Sufficient bearing area of packing shall be used to avoid damage to coatings.		A C E L M S

4.4.4 Site repairs/defects/uncoated areas
• Any coating repairs undertaken on the galvanizer's premises or later on site, e.g. touch up of small-uncoated surfaces (black spots), shall be strictly limited both in dimension and quantity as stipulated in the relevant SANS 121 (ISO 1461) specification.
• Any uncoated areas, modifications, transportation and erection damage, shall be repaired by abrading with 80 grit sand paper and painting with Zincfix, GalvPatch or equal and approved twin pack zinc rich epoxy paint, achieving an overlap of 5mm onto the surrounding sound zinc coating and to a minimum thickness of 100µm. When a duplex coating system has been specified the DFT of the repair coating shall be equal to that of the surrounding hot dip galvanized coating in terms of SANS 121 (ISO 1461). Steel shall not be accepted until the repaired surface has cured. Furthermore, in priority and as approved by the Engineer:
  ○ Black steel utilized in modifications with hot dip galvanized steel shall be dispatched for hot dip galvanizing. Any areas that are to be subsequently welded should either be masked prior to hot dip galvanizing or suitably cleaned of zinc in order to prevent possible weld metal embrittlement or zinc residue inclusions, prior to welding on site.
  ○ Alternatively, black steel utilized in modification with galvanized steel shall be abrasive blast cleaned to Standard SA 2½ to obtain a surface profile of 40 to 70 microns. Once the surface profile has been inspected and certified, apply zinc thermal sprayed coating to a minimum thickness of 120µm.
  ○ Alternatively, black steel utilized in modifications with hot dip galvanized steel shall be abrasive blast cleaned to Standard SA 2½ per International Standard ISO 8501-1 – 1988 to obtain a surface profile of 40 to 70 microns. Once the surface preparation has been inspected and certified, apply one coat of Zincfix, GalvPatch or equal and approved twin pack zinc rich epoxy paint, achieving a overlap of 5mm onto existing sound hot dip galvanized coating where black steel is welded to hot dip galvanized components. Dry film thickness shall be 100µm. When a duplex coating system has been specified the DFT of the repair coating shall be equal to that of the surrounding hot dip galvanized coating.
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5 DESIGN – FLOORS AND SURFACE BEDS		
5.1 Concrete Floor and Surface Beds		
5.1.1 General All concrete work shall be designed in accordance with SANS 10100-1 & 2 and carried out strictly in accordance with SANS 1200 G.		
5.1.2 Data Centre Halls, Meet-Me Rooms and Support Rooms Concrete surface bed to be 35/19Mpa with washed sand, 150mm thick jointed with fibre reinforcing "fibrin 900g/m³".(Mesh 395 only if required by client) Construction and Saw-cut joints to be max 4m x 4m panels, length to width ratios of the panels not to exceed 1,25. Levelness and flatness specification to be SABS 1200 class II. Damp proofing membrane 250 micron to be installed under surface beds on 20mm sand bedding. Minimum layer works below all floors; • 150mm layer G5 compacted to 95%Mod Aashto @ OMC • 150mm layer G7 compacted to 95%Mod Aashto @ OMC		A C E L M S
5.1.3 Offices and Ablutions Suspended floor slab: In-situ suspended concrete slab. The pre-stressed, pre-cast concrete floor slabs will be more economical due to the following reasons - substantial one-way spanning lengths; large area; rectangular layout of floor. Suspended reinforced concrete slab on load bearing brickwork designed for: • Occupancy load = 300 kg/m^2 • Partition load = 200 kg/m^2		A C E L M S

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6 DESIGN – LANDSCAPING AND RAINWATER HARVESTING		
6.1 Landscaping		
6.1.1 Landscaping ELIDZ palette of waterwise plants.		A C E L M S
6.2 Irrigation		
6.2.1 Irrigation No formal irrigation system to be provided.		A C E L M S
6.3 Rainwater Harvesting		
6.3.1 Main building Provide 8 x 5000l vertical water tanks, placed above ground on raised platform along northern façade. Tanks to be interconnected and include suitable submersible pump for connecting to landscaping/irrigation/grey water flushing system.		A C E L M S
7 DESIGN – WATER, WASTEWATER AND EFFLUENT		
7.1 Trade Effluent and Disposal		
7.1.1 General The design of the Civil Engineering infrastructure must be in accordance with the following as listed below: • Guidelines for the Provision of Engineering Services and Residential Amenities in Residential Township Development" (the Red Book) by the Department of Housing, 2000. • SABS 10252-1:2012 – Water supply and drainage to buildings • SANS 10400- building regulations • SANS 1200 AD, C, D, DB, DK, DM, GA, L, LB, LC, LD, LE, ME, MJ, MK, MM • ELIDZ Development Manual 24th Draft, 14th March 2011		
7.1.2 Responsibility Tenant is responsible for industrial effluent disposal and applications for Trade Effluent Permit.		A C E L M S
7.1.3 General Trade effluents that are discharged into the wastewater drainage system will fall under the control of BCM. Any person wishing to discharge Trade Effluent into the wastewater drainage system must apply to BCM for a license to do so. The wastewater must comply with BCM's standards for the acceptance of trade effluents into the municipal sewerage system.		A C E L M S
7.2 Water Supply		
7.2.1 Water Demand The ELIDZ water supply system has been designed to cater for an averaged demand of 20 kl/d/ha, with a peak day demand 4.2 times the average daily demand, equivalent to a peak flow of 0.97 l/s/ha. Special consideration should be given to the location of any industries and/or the reinforcement of the distribution system where the peak demand for potable water is expected to be in excess of 1.0 l/s/ha. A single water supply connection is provided by the ELIDZ, from a 110mm or 160mm existing erf connection. The existing connection consists of a uPVC main of class 9 pressure rating. Water supply will be split into domestic and fire main reticulation downstream of the water meter positioned within the property boundary. The water meter must be a "Sensus" Type automatic pulse meter 1:10 output. The meter is to be sized to allow operation flow to within 25% of the maximum allowable flow of the instrument. Isolation valves are to be installed and directional flow controlled with non-return valves. All control valves to be SANS 664 Left hand closing.		A C E L M S

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7.2.2 Fire Water Supply In addition to the above, the water reticulation system is designed to provide a fire flow of up to 50 l/s anywhere in the ELIDZ. The fire mains to be uPVC class 12 with a minimum diameter of 75mm.		A	
		C	
		E	
		L	
		M	
		S	
7.2.3 Refuse Yard A water supply and an appropriate drainage system are to be provided for washing the storage area.		A	
		C	
		E	
		L	
		M	
		S	
7.2.4 Static Pressures The maximum and minimum static pressures are 90m and 25m respectively.		A	
		C	
		E	
		L	
		M	
		S	
7.2.5 Auxiliary water storage See "Design Fire Protection" below.		A	
		C	
		E	
		L	
		M	
		S	
7.2.6 Excess water required In terms of the Conditions of Establishment of the ELIDZ, any industrialist wishing to draw in excess of 150 kl/day on an average must have approval of, and be licensed by the Department of Water Affairs and Forestry to do so.		A	
		C	
		E	
		L	
		M	
		S	
7.3 Access to Sewage and Water Reticulation			
7.3.1 Underground Sewers Underground sewers are provided to municipal sewer connection point. Sewer pipes to be uPVC Class 34 solid wall with a minimum diameter of 110mm.		A	
		C	
		E	
		L	
		M	
		S	
7.3.2 Industrial Effluent Sewer Drains The industrial effluent sewer drains must be provided to the tenant's wastewater treatment plant which is the responsibility of the tenant.		A	
		C	
		E	
		L	
		M	
		S	
7.3.3 Water Reticulation Water supply mains to buildings will provide domestic water at a rate of 4 kl per day per 1,000 m² of building floor area.		A	
		C	
		E	
		L	
		M	5200m2 – 20kl per day
		S	
8 DESIGN – STORMWATER, SUBSOIL AND WASTEWATER DRAINAGE			
8.1 Wastewater Drainage			
8.1.1 IDZ Wastewater Drainage System The IDZ wastewater drainage system conveys all sewage and industrial wastewaters generated in the IDZ. The system has been designed to cater for a peak flow of 0.8 l/s/ha.		A	
		C	
		E	
		L	
		M	
		S	

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8.1.2 Drainage connections Wastewater drainage connections have been provided for every erf. The connections are generally sited at the lowest point on the boundary and are approximately 1.0 m deep. The Connection has been established and tied into from site wastewater system.		A	
		C	
		E	
		L	
		M	
		S	
8.1.3 Water treatment plant Tenant's responsibility.		A	
		C	
		E	
		L	
		M	
		S	
8.2 Storm water Drainage			
8.2.1 50-Year Major Storm In terms of BCM's By-laws all new development proposals must provide for the on-site containment of a 50-year mayor storm, and have a controlled release of not more than a 5-year storm, with calculations based on maximum hardening. BCM has exempted all developments within Zones 1A, 1B and 1C from this requirement. Therefore, No stormwater management plan required.		A	
		C	
		E	
		L	
		M	
		S	
8.2.2 Piped Systems Zones 1A,1B and 1C have piped storm water drainage systems laid within the road reserves, and in Zone 1A the system has been extended to provide midblock connections to the erven. The piped storm water systems are generally designed to cater for the 1:5-year minor storm. Minor storms 1: 5y return period will be piped via concrete storm water pipes of class 100D minimum rating spigot socket type. Major storm 1:20y and greater will spill over onto road surfaces, flooding areas to be checked by Engineer, and reported and will be contained on hardstand areas along site boundaries. Where there is any possibility of damage or flooding of property downstream of the installation due to the above adequate allowance must be made in the piped system to accommodate the flooding. All manhole accesses in hardstand areas are to be of Heavy-Duty type SANS 558, Type 2A, "Modified "to be cast integrally with Hard Stand Concrete External hardstands are to be shaped and graded to allow uniform drainage to catch pits and storm water inlets along road edges Surface drains with heavy duty grill covers generally located at 24m centres to underground storm water pipes, will be located in open areas.		A	
		C	
		E	
		L	
		M	
		S	
8.2.3 Inlet Manholes Storm water runoff from the individual erven is to be discharged into the ELIDZ's piped storm water drainage system. In many cases, inlet manholes have been provided at low points on the erven for this purpose. An existing stormwater network exists along the property boundary of the site, tie into the network must be achieved from all developed erven. All manhole accesses in hardstand areas are to be of Heavy-Duty type SANS 558, Type 2A, "Modified "to be cast integrally with Hard Stand Concrete. External hardstands are to be shaped and graded to allow uniform drainage to catch pits and storm water inlets along road edges Surface drains with heavy duty grill covers generally located at 24m centres to underground storm water pipes, will be located in open areas where discharge to side inlets are not possible.		A	
		C	
		E	
		L	
		M	
		S	
8.2.4 Excess flows Flows in excess of the design capacity will drain overland, generally via the access roads onto the road network. The road network has been designed to divert the flow into the existing watercourses through the public open spaces. Where there is any possibility of damage or flooding of property downstream of the installation due to the above adequate allowance must be made in the piped system to accommodate the flooding.		A	
		C	
		E	
		L	
		M	
		S	
8.2.5 Liquids not permitted No domestic, industrial or process effluent, chemicals, oils, factory waste water etc. may be discharged into the storm water drainage system.		A	
		C	
		E	
		L	
		M	
		S	
8.2.6 Potential sources of contamination Potential sources of storm water contamination should be identified and measures taken to mitigate these at source by appropriate design of materials' storage and handling". Particular attention should be given to the following features: a) draining vehicle wash areas via oil trap into sewerage system; b) covering vehicle wash areas to ensure that the storm water does not drain into sewerage system;		A	
		C	
		E	
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		M	

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c) providing adequate bunding in the case of above ground fuel or chemical storage tanks to contain leaks and spills and prevent contaminants from being washed into the storm water drains; d) avoiding the storing and/or handling of chemicals or fuels in close proximity to the storm water drains; e) covering raw materials and waste storage areas to prevent contamination of storm water e.g. solid hazardous waste; f) providing grids to prevent litter and debris from entering the bulk storm water system.		S
8.3 Subsoil Drainage		
Detailed investigation is required into the potential of rising damp, within the factory footprint and when any possibility exists a network of below floor filter media must be designed. External sub soil drains below hard stand and cut faces will consist of conventional HDPE filter drains "Megaflow "or conventional 100mm sub soil perforated pipework with filter separator. The pipework will be installed to grade and discharged into the storm water network. The design must allow free drainage of all subsoil networks during peak floods Inspection facility "rodding eye" are to be provided on long runs. Filter media to be checked for permeability and piping.		A C E L M S
9 DESIGN – ELECTRICAL		
9.1 Design Criteria and Parameters		
The design criteria applied to the electrical engineering services shall include the following, namely: ❑ Capital costs ❑ Operational and maintenance requirements and costs ❑ Ease of functionality, operation and maintenance ❑ Compliance with general energy efficiency and / or sustainability standards Furthermore, the electrical engineering services shall be designed in accordance with, but not limited to, the current versions of the following, namely: ❑ the South African National Standard : Code of Practice for "The Application of the National Building Regulations" i.e. those included in the "National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977)", as published in the Government Gazette, number 31084, dated 30 May 2008, which became effective as of 01 October 2008, and known as "SANS 10400 - 2010" ❑ the Occupational Health and Safety Act, 1993 (Act 85 of 1993), ❑ SANS 204-1: 2008 - Energy Efficiency in Buildings: Part 1 - General Requirements, ❑ SANS 204-2: 2008 - Energy Efficiency in Buildings: Part 2 - The Application of the Energy Efficiency Requirements for Buildings with Natural Environmental Control, ❑ SANS 204-3: 2008 - Energy Efficiency in Buildings: Part 3 - The Application of the Energy Efficiency Requirements for Buildings with Artificial Ventilation or Air-conditioning, ❑ any other relevant by-laws of the Local Authorities, ❑ SANS 507-1: (NRS 034-1: 2007) Electricity Distribution - Guidelines for the Provision of Electricity Distribution Networks in Residential Areas (Part 1 : Planning and Design of Distribution Networks) ❑ SANS 10114-1: 2005: Interior Lighting ❑ South African National Standard: SANS 10142-1: 2003 - The Wiring of Premises: Part 1 - Low-voltage Installations ❑ "SANS 0313 - 1999: The Code of Practice for "The Protection of Structures against Lightning" All apparatus, components, parts, fittings and materials supplied and / or installed, whether specifically specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate current South African (SANS) or British Standard Specifications (BS) and Addenda thereto, except where otherwise required by this specification or permitted by approval of the Client / Employer, in writing. All materials and workmanship, which may, in the opinion of the Client / Employer, be inferior to that specified for the Work, will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the satisfaction of the Client / Employer. Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful completion of the installation is to be included so as to form a complete working installation.		A C E L M S
9.2 Building Classification		
The buildings shall be classified as follows, namely: ❑ Offices — "G1: Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage" ❑ Data Centre Halls — "D4: Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Utility Rooms — "D4: Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Gate House — "G1: Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage" ❑ Generator / Diesel Storage — "D4: Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" and "J1 High Risk Storage", with the definition "Occupancy where material is stored and where the stored material is liable, in the event of a fire, to cause combustion with extreme rapidity, or give rise to poisonous fumes, or cause explosions"		A C E . L M S
9.3 Definitions		
❑ Design — To create a plan or a specification for the construction of a system, or for the implementation of an activity or a process ❑ Supply — To purchase, procure and deliver complete with all related specified accessories ❑ Erect — To place or mount and fix in position		A C E

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❑ Install — To erect, connect up and commission, complete with related accessories ❑ Indicated shown, Noted — As indicated or shown on drawings ❑ Approved, Alternative — Approved in writing by the Client / Employer ❑ Similar, Equal — Equal or better in efficiency of performance and compatibility		L M S
9.4 Acceptance, Testing and Commissioning		
The Contractor shall allow for two representatives of the Client / Employer to participate in, and witness, all acceptance tests undertaken by the respective Manufacturers, for all major items of electrical equipment i.e. but not limited to, medium voltage switchgear, medium voltage equipment, generator set, uninterruptible set, main low voltage panels, electrical distribution boards, etc. The Contractor shall carry out all testing and commissioning required in terms of the respective Supplier specifications, relevant Acts, SANS Codes of Practice and Local Authority requirements. The Contractor shall provide all the equipment and apparatus required for the purpose of carrying out all necessary tests. The Contractor is responsible for carrying out all necessary tests and obtaining / preparing / issuing all necessary certificates for the installation and operation of the plant. If any part of the Works fails the test, the Contractor shall be responsible for rectifying, at his own cost, the defective Works and the re-testing thereof to ensure compliance. If in consequence, the Client / Employer are obliged to attend the further acceptance tests the additional costs incurred by the Engineers shall be payable by the Contractor. The Works shall be deemed to be practically complete only when the Client / Employer has approved all tests and inspections, and a Completion Advice Notice or other relevant completion notice is issued.		A C E L M S
9.5 Defects Liability Period		
The Contractor shall be responsible for the carrying out of inspections, services and maintenance-related tasks that are specified / recommended by the relevant Manufacturers / Suppliers for each component of the respective installations described herein, including but not limited to the following: Medium Voltage: ❑ clean and wipe down all equipment ❑ carry out a visual inspection of complete installation to ensure that all fittings are still in place, covers fitted properly, etc. ❑ check whether switchboard is still seated level ❑ verify that paint is in good condition ❑ check whether circuit breakers are still seated level ❑ check open and closed circuit breaker positions ❑ check all alarm and indication signals ❑ record number of operations, where applicable ❑ check pressure of SF6 gas ❑ verify that each cabinet is free of moisture and that respective heating circuit is operating ❑ check whether transformer is still seated level ❑ verify that paint is in good condition ❑ check oil level in main tank and conservator ❑ check condition of breather ❑ record winding / liquid temperature ❑ check medium and low voltage insulators ❑ check integrity of tank ❑ carry out thermographic imaging of transformer ❑ visual inspection of batteries ❑ visual inspection of electrolyte levels ❑ verify that no battery grounds exist ❑ check intercell impedance / resistance ❑ check strap resistance ❑ check individual cell voltages / total cell voltage ❑ equalize voltages ❑ record battery voltage and current ❑ verify charger alarms ❑ check voltage ripple Low Voltage and Building Services-related: ❑ test the incoming voltages and determine whether they are within normal parameters ❑ check all switchgear within the respective electrical distribution board ❑ test all earth leakage units ❑ test all socket outlets circuits i.e. one socket outlet per circuit to be tested in terms of correct earth leakage operation ❑ test all light switches and determine whether all light fittings are operating correctly ❑ test all photo-electrical daylight switches to ensure their correct operation ❑ check all isolators to ensure correct operation ❑ carry out a visual inspection of complete electrical installation to ensure that all electrical fittings are still in place, covers fitted properly, etc. Standby Generator: ❑ oil levels are correct ❑ radiator core for fouling ❑ radiator hose condition ❑ block heater working		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
❑ fuel level litres added ❑ fuel solenoid linkage for security ❑ governor operation ❑ voltage regular adjustment ❑ start battery electrolyte level ❑ control battery electrolyte level ❑ charging voltage ❑ housekeeping clean up ❑ record hours run time on start ❑ record kwh meter reading ❑ check fuel, oil, water and exhaust systems for leakages ❑ fan belt tension ❑ fan belt wear ❑ check battery terminals ❑ change engine sump oil ❑ change full flow oil filter ❑ empty, flush and refill radiator ❑ change bypass oil filter ❑ flush daily service fuel tank ❑ change fuel filter ❑ change air filter ❑ check and clear crankcase breathers ❑ check all nuts, bolts and clamps ❑ check starter motor solenoid ❑ check all electrical connections ❑ clean engine ❑ remove and clean air grilles ❑ inspect/check all alternator output connections ❑ clean alternator ❑ inspect all components and cubicle ❑ inspect all wiring and terminals ❑ clean switchboard ❑ test with load Uninterruptible Power Supply: ❑ check control switches and test on bypass ❑ check parameters of control board ❑ tested and inspection of all fans and filters ❑ check fuses ❑ check machines for common errors ❑ load tested to be actioned and battery life cycles to be calculated ❑ banks of batteries to be tested and replaced if necessary The Contractor shall ensure that the inspections, services and maintenance-related tasks are undertaken at intervals not greater than three months. The Contractor shall ensure that each inspection, service and / or maintenance-related task is undertaken in the presence of a representative of either the Client / Employer or the Client / Employer. The Contractor shall ensure that the necessary documentation is completed and submitted to the Client / Employer confirming the completion of the relevant tasks after every inspection, service and / or maintenance-related task milestone. The Contractor shall also timeously attend to any defects, which may occur through the normal operation of the Works. If, during the defects liability period, the installation is not in working order for any reason for which the Contractor is responsible, or if the respective installation develops a defect, the Contractor shall, immediately upon being notified thereof, take steps to remedy the defects and make any necessary adjustments. Should such stoppages, however be so frequent as to become troublesome, or should the installation otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Client / Employer, at his own expense replace the whole of the installation, or such parts thereof, as the Client / Employer may deem necessary with equipment specified by the Client / Employer. Upon completion of the defects liability period, the Client / Employer shall undertake the final inspection, service and / or maintenance-related task, as explained above and ensure that the necessary documentation is completed and submitted to the Client / Employer on behalf of the Client / Employer.		
9.6 Accreditation of Project		
It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance/ replacement, without impacting the proper operation of the Data Centre facility.		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
9.7 Detailed Schedule of Work		
9.7.1 Local Supply Authority The East London Industrial Development Zone is the licensed electricity supply authority within the defined industrial zone, and in terms of its authority granted by National Electricity Regulator (South Africa), has the right to supply electricity to all customers situated within the industrial development zone.		A C E L M S
9.7.2 Proposed Bulk Electricity Service Connection It is anticipated that the Data Centre shall eventually require an 11 000 V, dual, redundant, ring-fed, 2.0 MVA bulk electricity service connection. Although the medium voltage reticulation within the East London Industrial Development Zone has sufficient spare capacity to accommodate this project, an application shall still be submitted to the East London Industrial Development Zone for the necessary bulk electricity service connection, for record purposes. The East London Industrial Development Zone shall not impose any electricity service connection fees and / or electricity account deposits on the project. The project shall be responsible for the necessary medium voltage reticulation (2 off 11 kV cables installed in a ground trench) between the Data Centre and the existing medium voltage substation, known as "SS 1A4". The Client / Employer, under a separate contract, shall extend the existing 11 kV switchboard within the "SS 1A4" medium voltage substation and prepare same to accept the medium voltage reticulation installed by the project, en route from the Data Centre. The 11 kV switchboard shall be equipped with two 11000 V circuit breaker type feeder circuits for the purposes of providing the bulk electricity service connection to the Data Centre. These circuit breakers shall be equipped with all necessary metering and protection facilities as is required by the Client / Employer. As is required by the desired Tier Certification and Accreditation, the Data Centre shall be serviced by means of a bulk electricity service connection which has a dual, redundant and ring-fed capacity and configuration. Therefore, the medium voltage reticulation, as explained above, shall enter the Data Complex site at two differing positions, en route to the respective on-site medium voltage substations and provide an interconnection between the respective substations. It is envisaged that the Data Complex shall be serviced by two off medium voltage substations, which shall be termed "Substation A" and "Substation B". These respective substations shall comprise separate medium voltage and transformer rooms. The afore-mentioned anticipated bulk electricity service connection, and associated bulk electrical equipment, has been determined as follows: ❑ Electrical load drawn by data and associated equipment 1080 kW 1350 kVA ❑ Electrical load to be serviced by UPS system 1296 kW 1620 kVA ❑ Electrical load to be serviced by generator system 1555 kW 1944 kVA ❑ Size of transformer 2000 kVA However, in an effort to reduce the initial construction cost, the Client / Employer has indicated that the initial electrical demand may be deemed as follows: ❑ Electrical load drawn by data and associated equipment 360 kW 450 kVA ❑ Electrical load to be serviced by UPS system 432 kW 540 kVA ❑ Electrical load to be serviced by generator system 520 kW 648 kVA ❑ Size of transformer 600 kVA This project specification is based on the assumption that the anticipated bulk electricity service connection is to be provided. The Contractor is to construct the Data Centre, and all its Utility Rooms, as if the anticipated bulk electricity service connection is to be provided, but the Contractor may equip the Data Centre with the bulk electrical equipment necessary for the initial (reduced) electrical demand. It is of utmost importance that the Contractor constructs the Data Centre facility in such a manner that the provided bulk electrical equipment can easily and practically be upgraded / replaced with the equipment necessary for the anticipated electrical demand, without any subsequent builder's Works. Wherever possible, the bulk electrical equipment may be reduced in size and capacity, but the general characteristics and specifications thereof must remain as detailed herein. It is anticipated that the initial electrical demand can be serviced by means of 11 kV / 420 V / 600 kVA transformer units. Alternatively, the initial electrical demand may be serviced by means of 11 kV / 420 V / 630 kVA miniature substations. The miniature substation option reduces the necessity of medium voltage switchgear and medium voltage transformers. The Contractor is to consider this option and to prepare an alternative proposal on the basis thereof.		A C E L M S
9.7.3 Medium Voltage Equipment The medium voltage equipment, shall comprise the following, namely: ❑ Substation A, housing a four panel 11 000 V switchboard (with one "incomer" panel, one "interconnection feeder circuit en route to Substation B" panel, one "transformer feeder" panel and one "voltage transformer" panel) and a ❑ Substation B, housing a four panel 11 000 V switchboard (with one "incomer" panel, one "interconnection feeder circuit en route to Substation A" panel, one "transformer feeder" panel and one "voltage transformer" panel) ❑ All medium voltage equipment fed, and inter-connected, by a dual, redundant and ring-fed medium voltage cable network The specification of the medium voltage switchboard shall generally comply with the following specification, namely: **Item Description Details** *Note : All 11 kV switchgear shall be tested in accordance with the requirements of SANS1885:2015 Metal-clad switchgear for rated voltages above 1 kV and up to and including 24 kV : Part 1 : General Requirements and Methods of Test.* 1 General		A C E L M S

ELIDZ Design Specifications			Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
1.1	Nominal system voltage	12 kV		
1.2	Power frequency withstand voltage	28 kV		
1.3	Basic impulse level	95 kV		
1.4	Corrosion protection	Suitable for outdoor application in coastal areas, compliant to SANS1885 : 2015		
1.5	Paint colour	Light Grey, Colour G29 to SANS 1091 : 1975		
2	Particulars of Switchboard			
2.1	Designation	Applicable to Substation A and Substation B		
2.2	Number required	1 for Substation A and 1 for Substation B		
2.3	Nominal system voltage	12 kV		
2.4	Number of Switchgear Panels	4 (per substation) (as explained below)		
2.4.1	Incoming circuit breaker (s)	1 x 1 250 A 11 kV vacuum circuit breakers		
2.4.2	Outgoing circuit breaker (s)	1 x 1 250 A 11 kV vacuum circuit breakers		
2.4.3	Feeder circuit breaker (s)	0 x 1 250 A 11 kV vacuum circuit breakers		
2.4.4	Transformer circuit breaker (s)	1 x 1 250 A 11 kV vacuum circuit breakers		
2.4.5	Bus Coupler (s)	0 x 1 250 A 11 kV vacuum circuit breaker		
2.4.6	Voltage Transformer (s)	1		
2.4.7	Spare (s)	0		
2.5	11 kV busbar voltage transformer	11 000 / 110 V 100 VA Class 0.5 three phase units		
2.6	Statistical metering			
2.6.1	Transformer Feeder circuits	Three phase programmable time of use kWh / kVA meter, with pulsed outputs, connected to summation CT's monitoring the power consumption of the Transformer Feeders for check metering purposes		
2.7	Quality of Supply monitoring on the incoming supply (NRS 048)	Not required		
2.7	32 V (nominal) 29 Ah dc Battery tripping unit	Required		
2.7.1	Cabinets	3CR12 self-contained cabinet; finishes to match that of the switchboard		
2.7.2	Battery Charger	10 A continuous CVC current limit Float voltage : 34.1 V Boost voltage : 38.4 V Input voltage : 230 V +-10% Regulation (dc) : +- 1%		
2.7.3	Battery installation	29 Ah, L29P vented nickel cadmium with bolted interconnections		
2.7.4	Battery trip unit controls	Main incoming isolator Float / boost switch DC voltmeter (analogue) DC ammeter (analogue) DC output main isolator (60 A double pole) 2 x DC output circuit breakers (32 A double pole) AC / DC / Battery terminal blocks Low battery voltage alarm Charger fail alarm DC output fail alarm AC mains failure Battery high volts alarm		
3	Particulars of Circuit Breakers			
3.1	Interrupting medium	Vacuum		
3.2	Current rating of circuit breaker	1 250 A		
3.3	Current rating of busbars	1 250 A		
3.4	Busbar configuration	Single		
3.5	Fault level	25 kA (11 kV) 3 second rating		
3.6	Local operating conditions	Max temperature : 40 degrees Celsius, with 98% Humidity		
3.7	Circuit breaker mechanism	Motor charged spring closing mechanism		
3.7	Charging motor / auxiliary supply voltage	30 V dc		
3.9	Maximum spring recharge time	10 seconds		
3.10	Maximum break time	50 milli-seconds		
3.11	Maximum closing time	40 milli-seconds		
3.12	Spring release and shunt trip coil rating	30 V dc		
3.13	Spring charged indication	Required		
3.14	Circuit breaker remote opening & closing plug & extension	10 m remote operating switch required		
4	Particulars of Incoming Circuit Breaker Panels			
4.1	Current transformers	800 / 400 / 1 A, 10 VA Class 10P10 800 / 400 / 200 / 1 A, 10 VA		

ELIDZ Design Specifications			Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
4.2	Protection relays and measurement equipment required	Three phase over-current and earth fault relay (Micom P122) Trip circuit supervisory relay (see below detailed specification for relays and measurement equipment)		
4.3	Local indication equipment	11 kV busbar voltmeter 3 x MDI Ammeters 0 / 200 / 400 A Breaker open indication lamp Breaker closed indication lamp Breaker spring charged indication lamp Cable Alive Neon Indication Lamps Fault counter Panel label All equipment labelling		
4.4	Local control equipment	Voltmeter selector switch Breaker control switch Local / Remote Selector Switch Lamp test switch Remote operating connection plug		
4.5	Local protection auxiliary equipment	2 no. CT test blocks (PK2 protection & C&H metering) Main Tripping Circuit DC MCB (20 A double pole) Closing Circuit DC MCB (20 A double pole) Spring charge DC MCB (20 A double pole) VT MCB's (2 A single pole) VT selection auxiliary relays Cable compartment anti-condensation heaters		
4.6	Supervisory indication requirements to be provided for remote indication	Breaker open Breaker closed Cable earth on Breaker racked out / in service position		
4.7	Supervisory alarm requirements to be provided for remote indication	Supervisory isolated Protection not healthy O/C or E/F trip Circuit breaker spring discharged Trip circuit fail Auxiliary supply fail		
4.7	Supervisory analogue signal requirements to be provided for remote indication	Current - White Phase (4 - 20 mA output) Power (4 - 20 mA output) Voltage (4 - 20 mA output)		
4.9	Incoming cable details	XLPE insulated, steel wire armoured 70 mm^2 x 3 core, 6.35/11 kV cable, Type A (all in accordance with SANS 1339) and 70 mm^2 bare stranded copper earth wire *(or as per final design)*		
5	Particulars of Local Transformer Circuit Breaker Panel			
5.1	Current transformers	800 / 400 / 1 A, 10 VA Class 10P10 multi ratio 200 / 100 / 1 A, 10 VA Class 0.5 multi ratio		
5.2	Protection relays and measurement equipment required	Three phase over current and earth fault relay (Micom P122) Trip circuit supervisory relay Buchholz & oil temperature auxiliary (Alarm & Trip) (Alstom MVAA) Intertrip relay (Micom MVAJ)		
5.3	Local indication equipment	MDI Ammeter 0 / 100 / 200 A Breaker open indication lamp Breaker closed indication lamp Breaker spring charged Indication Lamp Fault counter Panel label All equipment labelling Oil temperature alarm Oil temperature trip Buchholz alarm Buchholz trip		
5.4	Local control equipment	Breaker control switch Local / Remote Selector Switch Lamp test switch Remote operating connection plug		
5.5	Local protection auxiliary equipment	2 no. CT test blocks Main Tripping Circuit DC MCB (20A double pole) Closing Circuit DC MCB (20A double pole) Spring charge DC MCB (20A double pole) Cable compartment anti-condensation heaters		

ELIDZ Design Specifications				Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
	5.6	Supervisory indication requirements to be provided for remote indication	Breaker open Breaker closed Cable earth on Breaker racked out / in service position		
	5.7	Supervisory alarm requirements to be provided for remote indication	Supervisory isolated Protection not healthy O/C or E/F trip Circuit breaker spring discharged Trip circuit fail Auxiliary supply fail Oil temperature alarm Oil temperature trip Buchholz alarm Buchholz trip		
	5.7	Supervisory analogue signal requirements to be provided for remote indication	Current - White Phase (4 - 20 mA output) Power (4 - 20 mA output) Voltage (4 - 20 mA output)		
	5.9	Incoming cable details	XLPE insulated, steel wire armoured 70 mm^2 x 3 core, 6.35/11kV cable, Type A (all in accordance with SANS 1339) and 70 mm2 bare stranded copper earth wire *(or as per final design)*		
6		Particulars of Bus-Section Circuit Breaker Panel			
	6.1	Current transformers	Not Required		
	6.2	Protection relays and measurement equipment required	Not Required		
	6.3	Local indication equipment	Breaker open Breaker closed Breaker not healthy Fault counter Panel label All equipment labelling		
	6.4	Local control equipment	Breaker control switch Supervisory isolating switch Lamp test switch Remote operating connection plug		
	6.5	Local protection auxiliary equipment	Main DC circuit breaker (20 A double pole) Spring charge DC circuit breaker (20 A)		
	6.6	Supervisory indication requirements to be provided for remote indication	Breaker open Breaker closed Cable earth on Breaker racked out		
	6.7	Supervisory alarm requirements to be provided for remote indication	Supervisory isolated Circuit breaker spring discharged Auxiliary supply fail		
The protection relays and electrical measurement equipment shall generally comply with the following specification, namely:					
Item		**Description**	**Details**		
Note : All 11 kV switchgear shall be tested in accordance with the requirements of SANS 1885:2015 Metal-clad switchgear for rated voltages above 1 kV and up to and including 36 kV : Part 1 : General Requirements and Methods of Test.					
1		Protection Relays			
	1.1	Over current & earth fault relay (Alstom MiCOM P122 or equal and approved)	Three phase and earth relays Three independent phase and earth over current stages High set instantaneous phase over current		
	1.2	Trip circuit monitoring	Trip circuit supervision with circuit breaker in opened and closed state to be monitored with an input of the Micom P122 Operation indicator required		
	1.3	Buchholz & oil temperature auxiliary relays (Alstom MVAA or equal and approved)	Operated by either the oil temperature trip setting, or the Buchholz relay Operation indicator required		
	1.4	Intertrip relay	Inter-trip circuit between transformer LV and MV circuit breakers Operation indicator required		
2		Metering equipment			
	2.1	Customer energy and demand electricity metering : ABB type "Elster A1700" or equal and approved	3 phase 4 wire 11 kV / 1 A Class 0.5 Optical local reading port RS232 communication port		
	2.2	Customer (direct reading) energy and demand metering	Three phase, four wire 420 V / 100 A polyphase integrating kWh/kVA meter		
3		Power quality monitoring equipment			
	3.1	Not required			

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4 Current transformer test blocks

4.1 Four-way current transformer test blocks to be installed on all protection, metering and indication current transformer circuits, complete with voltage terminals, and front or rear entry to suit panel manufacture (PK2 for protection and C&H for metering)

The medium voltage transformers shall generally comply with the following specification, namely:

Item	Description	Details

Note : All 11 kV / 420 V transformers shall be manufactured and tested in accordance with the requirements of NRS 005-1990 and SABS 780.

1.1	Designation	Transformer A and Transformer B
1.2	Quantity	2
1.3	Compliance	SANS 780
1.4	Nominal system voltage	11 kV
1.5	Rated no-load secondary voltage	420 V
1.6	Minimum MV power frequency withstand test voltage	12 kV
1.7	MV cable box and bushings	Yes, welded onto transformer frame with bottom cable entry facilities, air medium and MV bushings to NRS 008
1.7	MV cable	XLPE insulated, steel wire armoured 70mm^2 x 3 core, 6.35/11kV cable, Type A (all in accordance with SANS 1339) and 70 mm^2 bare stranded copper earth wire
1.9	MV cable terminations	Heatshrink
1.10	Transformer Requirements	
	Rating	2000 kVA
	Vector group	Dyn11
	Windings	Copper
	MV system earthing	Solid
	MV system fault level	25 kA
	Off-load tapping switch	Required (-5%, -2.5%, 0%, +2.5, +5%)
	Conservator	Required, with drain plug
	Oil level indicator	Required (Prismatic Flat Type)
	Transformer rating plate	Required
	Thermometer pocket	Required
	Indicating thermometer	Required (with alarm & trip contacts)
	Silica gel breather	Required
	Buchholz relay	Required (with open contacts)
	General	Lifting lugs Jacking pads Corrugated radiator Drain and filler valves and plugs
1.11	LV cable box and bushings	Yes, welded onto transformer frame with bottom cable entry facilities, air medium and LV bushings to NRS 008 and aluminum gland plate
1.12	LV cable	5 x 630 mm^2 single core XLPE with copper conductors on each phase, with 2 x 300 mm^2 single core XLPE with copper conductors for the neutral *(or as per final design)*
1.13	LV cable terminations	Cable clamping to suit LV cables to be provided in air cable box Aluminum gland plate Auxiliary terminal box
1.14	Auxillary cable box	Yes, welded onto transformer frame with bottom cable entry facilities, air medium and LV bushings to NRS 008 and aluminum gland plate
1.15	Auxillary cable	2.5 mm^2 x 12 core PVC insulated with copper conductors (numbered)
1.16	Auxillary cable terminations	Cable clamping to suit LV cables to be provided in air cable box Aluminum gland plate Auxiliary terminal box
1.17	Earth	Earth bar on LV side
1.18	Construction	Indoor
1.19	Underbase	Skid type
1.20	Corrosion protection - general	Suitable for outdoor application in coastal areas, compliant to NRS 003-1
1.21	Corrosive protection - radiator	Galvanised (to SANS 121:1999)
1.22	Corrosive protection - transformer tank	Zinc metal sprayed
1.23	LV Neutral terminal rating	Equal to phase terminal rating & utilise identical bushing
1.24	Paint colour	Navy Light Grey, Colour G35 to SANS 1091 : 1975

Transformers A and B will be connected to the same medium and low voltage network, with possible interconnection. Hence, they are to be identical w.r.t. physical and electrical characteristics.

9.7.4 Medium Voltage Cables

9.7.4.1 General

All single core and three core cables with stranded copper conductors and insulated with cross linked polyethylene, shall comply with SANS 1339.

A	
C	

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Conductors shall comprise standard annealed copper, complying with the requirements for class 2 conductors in SANS 1411-1. All single core cables shall comply with the requirements given in tables 11, 12 and 13 of SANS 1339:1981. All three core cables shall comply with the requirements given in tables 23, 25 and 26 of SANS 1339:1981 for type A cable and tables 29, 31, 32 and 33 for type B cables..		E L M S
9.7.4.2 Installation The cable shall be removed from the drum in such a manner that the cable is not subjected to twisting or tension exceeding that stipulated by the cable manufacturer. Cable rollers shall be used to run out cables. Rollers shall be spaced so that the length of cable in the trench shall be prevented from touching the ground. The spacing between rollers shall not exceed 3 meters. Lubricated skid plates shall be used where cables have to be drawn around corners. Where cables have to be drawn through conduits or ducts, a suitable cable sock shall be used and particular care shall be exercised to avoid abrasion. The maximum allowable tension when pulling a cable is 70 N/mm^3 of phase conductor area, and the maximum speed at which cable shall be drawn shall not exceed 10 meters/minute. Where cables are cut and not immediately made off, the ends are to be sealed without delay by means of an approved method. Where cables are installed around corners, the minimum radius of curvature must not be less than "12d", where "d" is the overall diameter of the cable. Cables shall be installed at the minimum depth of 900mm below ground level or as otherwise specified in the Detailed Specification. Cables installed in the same trench shall be laid parallel to each other with a minimum horizontal clearance between adjacent cables equal to twice the overall diameter of the larger cable. Cables laid beneath road crossings shall be laid at a depth of 1200mm, measured to the top of the cable. All cable conduits shall be HDPE thick wall type to EN50086-2-4:1991. One 160mm diameter conduit shall be provided for each 11 kV cable at each road crossing. Each conduit shall extend at least 1500 mm on either side of the road. All conduits not containing cables, shall be provided with a 1.6mm diameter galvanised steel draw wire or PVC draw tape and shall be sealed with a watertight end cap at each end. All cables shall be fitted with identification labels. Identification labels shall be of flat lead with 9mm punched characters as an identification code. Labels shall be fitted to cables at each end and at 10m intervals. The medium voltage cables, or where applicable, the ducts, shall be placed on a bed of 75mm of sifted sand, and covered with a bed of 200mm of sifted sand, over the entire length. Pre-cast concrete cable slabs, 500mm long x 250mm wide x 50mm thick, are to be placed immediately above the 200mm bed of sifted sand.		A C E L M S
9.7.4.3 Cable Jointing Jointing of cables must be restricted to an absolute minimum and shall not be carried out during overcast conditions. At every MV cable joint, the cable shall be looped in the ground to allow for future re-making of the joint, should this become necessary. The jointing of XLPE cables is to be carried out using 3 M, Sigmaform or Raychem type jointing kits. The procedure for preparing the two cable ends for jointing shall be carried out in accordance with the recommendations provided by the supplier of the jointing kit. Care must be taken when ring cutting to remove the inner jackets as damage to the copper shielding tapes could result in a failure of the joint. Only aluminum oxide abrasive cloth shall be permitted for sanding procedures. Special care shall be observed when preparing the ends of XLPE cables such that the underlying insulation does not become damaged when removing semi-conducting screens. A special rotating tool shall be used to remove semi-conductive layers. The correct size ferrules must be used. An hexagonal crimping tool shall be used. All sharp edges shall be filed smooth. Where applicable, the armour continuity sock, bridging the armouring at the joint, shall be adequate to carry the fault current and shall not be less than 7 mm^2. One constant force roll spring shall be used at either end of the joint to ensure uniform contact pressure between the earth sock and the armouring.		A C E L M S
9.7.4.4 Termination Cables Cable ends shall be terminated with glands or in cable boxes with the associated accessories such as clamps, shrouds, etc. in a manner recommended by the manufacturer. The termination of cables shall not be carried out during overcast conditions. At every cable termination, the cable shall be looped in the ground to allow for future re-making of the termination, should this become necessary. XLPE cable terminations shall be carried out using 3M, Sigmaform, Raychem or pre-stressed sleeves of the 3M type. Sheds shall be used on outdoor terminations. The procedure, dimensions and method of preparing and terminating an XLPE cable end shall be in accordance with the supplier's recommendations of the termination kit chosen. A copper earth braid with a minimum cross-section area of 50sq/mm is to be connected to each copper screen and to the armour using steel constant force roll springs to ensure uniform contact pressure between the earth braid and the screen. The screen and armouring braids shall be bonded to the main earth bar of the transformer, but the bond shall be easily removable for testing purposes. The manufacturer's insulation clearances between the copper screens and the armouring shall be adhered to, so that the testing procedures, detailed in the Specification, can be applied. Correctly sized lugs shall be crimped onto the ends of the cable using the correctly sized hexagonal crimping tool. The lug hole size shall match that of the termination bolts. A pre-stretched tube or heat shrink tube shall be placed over the end lug and switchgear spout to completely insulate the termination. Taping of the end lug shall not be allowed.		A C E L M S

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Cable end boxes shall be installed, as specified, to prevent mechanical damage or access to the terminals
Cable end boxes shall not be filled with any type of filling compound.
The dimensions of the cable end box shall be such that the crutch of the termination shall fall inside the box.
The cable shall be clamped outside the cable end box using suitable wooden clamps
Where it is not possible to provide a cable end box, a suitable bracket or other approved means of support shall be provided to remove mechanical stress from the cable termination and crutch.
Where the cable is to terminate on a transformer pole or on an overhead line structure, the cable shall be secured to the pole with acceptable clamps or straps. For terminations on a transformer pole, the cable shall be taken to 1 meter above the transformer bushings.

9.7.4.5 Testing

Each cable shall be tested after installation in accordance with SANS 1339 for cross-linked polyethylene (XLPE) insulated cables.
MV cables shall be pressure tested after installation in accordance with the tables below and the exact leakage current shall be tabulated and certified.
All tests shall include the identification of the phase rotation applicable to each section of each of the 11kV underground reticulation circuits. The phase rotation of each section shall be recorded on the associated terminal equipment and in the Record Drawings.
Furthermore, the tests shall include:

Cable Rating (Volts)	Test Voltage (Volts)	
	Conductors to screen / binder / armour	Between overall copper screen and armour
	(Applied for 15 minutes)	(Applied for 1 minute)
	DC	DC
2.6 / 6.6	11	4
6.35 / 11	18	4

The copper screens, copper cores and armouring of cable, shall be commonly bonded during sheath testing. If the cable breaks down during the sheath test, the Contractor shall be required to rectify the fault to the satisfaction of the Client/ Employer.
The Contractor shall notify the Client/ Employer timeously, so that their representative may witness the tests. On completion of the tests, the Contractor shall submit three copies of the certified test reports to the Client / Employer.
The Contractor shall make provision for the liaison with the Client/ Employer's relevant operational staff, and to arrange all interruptions to the electricity services as may be required to execute the Works in accordance with the procedures specified by the Client / Employer. Such provision shall include, but shall not be restricted to:

- Arranging and attending meetings with the operational staff in order to finalise Work programmes and interruptions to supply,
- Coordinating the isolation, issue of Permits to Work, earthing and de-isolation process with the operational staff,
- Undertaking such Works as required by the operational staff outside of normal working hours, in order to limit the impact of the Works on electricity customers,
- Arranging for the inspection by the operational staff of the completed Works, prior to handing over the Works to the relevant institution.

No additional payments shall be certified to the Contractor for additional preliminary and general, dayworks or labour rates resulting from the Contractor having to comply with the above conditions.

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9.7.4.6 Cable Markers

The cable markers shall consist of a concrete block in the shape of a truncated pyramid, approximately 300mm deep x 150mm x 150mm at the top and 230mm x 230mm at the bottom. An aluminium indicator plate shall be cast onto the top of the marker.
Indicator plates shall have the following inscriptions:

- CABLE / CABLE SLEEVES
- INDICATE NUMBER AND SIZE

Markers for cable joints shall have the following stamped inscription on the indicator plate :

- CABLE JOINT No

Markers shall be placed at regular intervals along the cable routes, approximately 50 meters apart and also at all changes in direction with arrows indicating route of cable.
A sample of the proposed markers shall be submitted to the Client / Employer for approval before they are manufactured.
The position of the cable markers shall be indicated on the Record Drawings.

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9.7.4.7 Crossing of Existing Services

The Contractor shall acquaint himself with all services that are existing and to be maintained to ensure that any excavations he may undertake will not damage or hinder such services or expose his work to possible damage by others.
The Contractor will be held responsible for damage to any existing or concurrently installed service, which might be brought to his attention by the relevant authority and shall be held responsible for the cost of any repairs.

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9.7.5 Power Factor Correction and Harmonic Filtration

The Contractor shall be responsible for the design and supply of necessary power factor correction and harmonic filtration equipment, designed to service the electrical installation.

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ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
9.7.6 Low Voltage Reticulation The low voltage reticulation shall comprise the following, namely: ❑ Main Low Voltage Panel, termed MLVP A, housed within LV Room A ❑ Main Low Voltage Panel, termed MLVP B, housed within LV Room B ❑ A series of electrical distribution boards throughout the Data Centre *(note: all electrical distribution boards and associated low voltage cables necessary for the User's internal electrical installation shall be provided under this contract)* ❑ All main low voltage panels and respective electrical distribution bards shall beinter-connected by a low voltage cable network The Contractor shall be responsible for the supply and installation of all necessary electricity feeder cables between the main low voltage panels and their respective electrical distribution boards. Where applicable, electricity feeder cables shall be Cu PVC PVC SWA ECC PVC cables, with stranded conductors. The storage, transportation, handling and laying of the cables shall be according to first class practice, and the Contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations. All low voltage reticulation cables shall have been manufactured to SANS 1507 - 1990 and shall have stranded copper conductors with PVC insulation, PVC bedding, steel wire armouring and PVC sheathing. No jointing of the low voltage reticulation cables will be allowed, without the prior consent and approval of the Client/ Employer. Cables shall be fitted with suitable flameproof identification labels at both ends and at appropriate, intermediate positions. The labels shall bear the identification of the boards of origin and destination. The cable installation shall be coordinated with the other services i.e. water pipes, etc. The Contractor shall timeously notify the Client / Employer of any clashing of services i.e. electrical cables and water pipes installed in close proximity to each other, etc. The laying of cables shall not be commenced until the trenches, ducts, wiring ducts, cable trays or cable ladders have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused and 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 approval after drawing in of the cables. Where cables are cut and not immediately made off, the ends are to be sealed. 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 500 V for low voltage cables. The Contractor shall be responsible for the supply and installation of all ducts, wiring ducts, cable trays or cable ladders, including all necessary suspension brackets and fixing materials, as is necessary for the low voltage reticulation installation.		A C E L M S
9.7.7 Builder's and Related Works The Contractor shall be responsible for the necessary co-ordination and timing of the builder's and related Works pertaining to this Contract. All Utility Rooms shall be constructed with the necessary floor trenches for the installation of all associated electrical services.		A C E L M S
9.7.8 Trench Excavation The Contractor shall undertake all trench excavations, including backfilling and compaction, required for the electrical installation. Where possible, all routes should be either parallel or perpendicular to the nearest building and / or structure, maintaining a minimum distance of 0.5 mm from the edge of the foundation of the boundary wall and or building walls. The Client / Employer should be notified immediately should any deviations to the routes be required. The cable-trenches shall be excavated to a depth of 800 mm deep below ground level and shall be 500 mm 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. The bottom of the trench shall be level and clean and the bottom and sides free from rocks or stones liable to cause damage to the cable. The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage. In the trenches the cables shall be laid on a 75mm thick bed of earth and be covered with a 150mm layer of earth before the trench is filled in. Trenches are to be backfilled and consolidated in stages (150mm intervals) to prevent subsequent subsidence. Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required. All compactions shall be to MPa density of 93% AASHTO density. Any subsidence, either during the construction period, or the guarantee period, shall be remedied. The backfilling of all post-mounted, or similar, luminaires shall be done with a 10:1 sand / cement mix.		A C E L M S
9.7.9 Brick-built Enclosures (Manholes) The Contractor shall be responsible for the provision of the brick-built enclosures (manholes). The manholes shall be constructed on a mass concrete Class D base, 150mm thick and projecting 150mm all way round, and comprise two-brick thick walls, plastered internally, and fitted with a (minimum) 600mm diameter, heavy duty, Type 8UA frame and lid. The Contractor is to ensure that all manholes are waterproofed.		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
9.7.10 Ducts The Contractor shall be responsible for the provision of all ducts necessary for the electrical and, telecommunications and associated installations. In summary, ducts shall be installed beneath (across) all walkways, driveways, and finished surfaces. The ducts shall be manufactured from a high-density polyethylene with a double wall construction, allowing a corrugated outer wall finish and a smooth inner wall finish, and of the internal diameters as indicated on the attached drawings. All ducts shall be minimum 160mm outer diameter, with minimum 137mm internal diameter. Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in high-density polyethylene pipes. The ends of all ducts shall be sealed with a non-hardening watertight compound after the installation of cables. All ducts intended for future use shall be sealed.		A C E L M S
9.7.11 Access Floor The Contractor shall be responsible for the provision of all raised access floors within the respective Data Centre Halls, Meet Me Rooms, etc. The access floor shall be utilized for the purposes of reticulating and distribution the various electrical, mechanical and telecommunications systems into the respective Data Centre Halls, Meet Me Rooms, etc.		A C E L M S
9.7.12 Standby Generator Set Installation The Contractor shall provide a highly efficient, scalable, three phase power protection unit with flexible operating modes suitable for Data Centre facilities, as manufactured by Schneider Electric. The unit provided shall, as a minimum, meet the specification of the Schneider Electrical 500 kW to 1500 kW, Galaxy VX product range. The generator shall generally comply with the following, namely: **General** Continuous Rating — 1,950 kVA (prime power) @ 0.8 p.f. Rated Output — 420 V @ 50 Hz Nominal Speed — 1 500 rpm Type (and Enclosure) — Manufacture diesel-driven standby generator set, complete with soundproof and weatherproof, epoxy-powder coated 3CR12 enclosure continuously rated, complete with specified automatic mains failure equipment Finish — All engine, alternator and control panel components to be primed and painted with an epoxy powder coating (Signal Red, colour A11 of SANS 1091) Lightning Ground Flash Density — To be designed in accordance with SABS 03 – 1985 Location — Installed within the Generator Room located on ground level Operation and Maintenance Manuals — Operation and Maintenance Manuals shall include (but not be limited to) a complete schematic diagram of the generator set's operation and control circuitry **Diesel Engine and Mechanical Plant** Type — Water-cooled Alternator / Engine Coupling — Direct Base — Mild steel skid frame (to SANS 763), painted with an epoxy powder coating (black), with anti-vibration mountings Fuel Tank — Type and Capacity: Base-mounted integral 3CR12 fuel tank, sized to accommodate sufficient fuel for a minimum 8 hour operation (at full load) Upon final positioning of the generator set, the fuel tank is to be filled with appropriate fuel Fuel Tank Accessories — Level indicator, calibrated in litres Filler cap Drain plug Low level alarm (@ 25%) Interconnecting hoses Electrically-operated fuel filling pump (for re-filling purposes) Starting — 12 V dc Battery — 12 V maintenance free, housed within the generator enclosure, with a galvanised frame, painted with an epoxy powder coating (black) Radiator — Integral, with generator set Engine Supervisory Equipment — High temperature alarm / shutdown Low oil level alarm / shutdown Over / under speed alarm / shutdown Low level fuel alarm / shutdown Start failure alarm (after three attempts) All alarms to be provided with potential free contacts, terminated in a common row of terminal blocks for interfacing with remote supervisory equipment) One alarm hooter and red light shall be supplied and installed on the outside of the Generator Room. The hooter shall be an electronic unit similar and equal to a "Klaxon" "SY2/725" hooter with a continuously		A C E L M S

ELIDZ Design Specifications		Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
	rated output of 110 dB at a distance of 2 metres, and shall be IP55 weatherproof rated. The warning light shall consist of a 40 W flashing red light. The hooter and light shall be switched on or off simultaneously after initiation or cancellation of an alarm condition. The hooter control circuit is to reset automatically after cancellation due to a low fuel condition or battery charger failure, but the visible fault indication must remain, i.e. should the operator continue to run the set, the hooter must sound, should any other condition develop.		
Exhaust	Base mounted with 3CR12 flexible piping and silencer, suitable for operation within a residential environment Exhaust system to be complete with all necessary suspension / mounting brackets		
Exhaust Emissions	To be in accordance with the European Union (EU) Tier 2 exhaust emission regulations		
Water Jacket Heating	Required to automatically maintain engine block temperature		
Extraction Fan	As is required for proper operation of the generator system within the design Generator Room		
Alternator			
Enclosure	Drip-proof		
Rating	3 phase, to suit specified power output, under site conditions		
Type	Brushless		
Insulation Class	F		
Maximum Frequency Variation of AMF Unit	2.5 %		
Transient Voltage Dip of AMF Unit (@ full load)	15 %		
Voltage recovery of AMF unit (@ full load)	300 mS		
Controller			
Controller	One required, to monitor supply under-voltage and / or supply over-voltage and / or supply voltage phase failure, and to provide remote display of "Mains Supply Failure" and "AMF Plant Operational" (All alarms to be provided with potential free contacts, terminated in a common row of terminal blocks for interfacing with remote supervisory equipment)		
Change-over Contactors	Mechanically and electrically interlocked to suit the specified output current at AC3 continuous rating		
Control Panel			
Type	Integral type panel Panel fabricated from 2 mm 3CR12 and to comply with specifications for electrical distribution boards		
Fault Level	15 kA		
Instrumentation			
Ammeters	3 x 600 A thermal maximum demand ammeters on low voltage main circuit to sit AMF Unit rating		
Voltmeter	One 0-500 V voltmeter, with voltage selector switch and 4 no. 2A fuses		
Power Factor	One required		
Frequency Meter	One required		
Hour Run Meter	One required		
Battery Charge Ammeter	One required		
Battery Voltmeter	One required, with test push button		
Circuit Breakers	1 no to protect alternator 1 no. as outgoing circuit 1 no. for water jacket heater (or, as required) 1 no. for battery charger (or, as required) 1 no. for control circuit (or, as required) Others as may be required for operation of generator set		
Battery Charger	One required, with auto boost / float voltage charge control to suit local starting and control requirements		
Mode Selector Switch	"Off" - all circuits isolated "Manual" - push button start of engine for maintenance purposes, but no automatic change-over operation in the event of mains failure "Test" - push button start of engine for maintenance purposes, but allows automatic change-over operation in the event of mains failure "Auto" - automatic starting and stopping of AMF plant, dependent on the main supply voltage condition		
Shutdown Delay Timer	Required to delay AMF shutdown by up to two minutes (adjustable) in the "auto" mode, upon restoration of the mains supply voltage		
Weekly Operation	The generator set shall be programmed to automatically start and run off-load for 15 minutes at weekly intervals (a convenient time must be determined in conjunction with the Client / Employer)		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
The control of the standby diesel-driven generator set shall be by means of protection, control and automatic mains failure equipment housed within the respective main low voltage panels. **Factory Acceptance Testing** The factory acceptance testing exercise shall be undertaken on the Generator Supplier's premises. The Generator Supplier shall ensure that they have the necessary test equipment to perform all required testing. The following tests shall be carried out on the generator set and associated equipment during the factory acceptance testing, but not limited to, namely: ❑ high voltage test of 2 000 V, 50 Hz, tested for 1 minute per phase to earth (with remaining phases earthed) ❑ a 1 000 V Megger test on all insulated sections between phases and between phases and earth (resistance readings not to exceed 1 000 Mega ohms) ❑ starting and stopping procedures, in "manual" and "automatic" status ❑ full load testing, for a minimum period of 30 minutes ❑ simulation of all possible conditions / failures i.e. - supply voltage "failure" - supply voltage "under-voltage" - supply voltage "over-voltage" - supply voltage "phase failure" (on all three phases) - supply voltage "frequency" - generator "start failure" - generator "under-voltage" - generator "over-voltage" - generator "phase failure" (on all three phases) - generator " under frequency / over frequency" - generator "over-load" - generator "high temperature" - generator "low fuel level" - generator "low water level" - generator "low oil level" - generator "over-heating" - emergency stop - any other testing that may be deemed appropriate ❑ full operational tests of all control circuits, relays and switchgear ❑ a trip test of all earth leakage relays, creating an earth fault on each of the protected circuits ❑ a current injection trip test on all main breakers to ensure that they trip at their set currents **Factory Acceptance Testing** If any part of the Works fails the factory acceptance testing, the Generator Supplier shall be responsible for rectifying, at his own cost, the defective Works and the re-testing thereof to ensure compliance. Upon successful completion of the factory acceptance testing, the Generator Supplier shall be given permission to arrange and coordinate the delivery of the unit to site. **Spares and Tools** The Contractor shall provide all spares necessary for twelve months' of servicing and a complete set of tools to undertake such servicing. **General** As mentioned under the clause, entitled "Proposed Bulk Electricity Service Connection", in an effort to reduce the initial construction cost, the Client / Employer has indicated that the initial electrical demand may be deemed as 360 kW (as opposed to the anticipated electrical load of 1080 kW). Therefore, the generator set (s) initially provided may be designed such that it (they) are servicing a 520 kW / 648 kVA electrical load, scalable to the 1555 kW / 1944 kVA electrical load in the future.		
9.7.13 Uninterruptible Power Supply Installation The Contractor shall provide a highly efficient, scalable, three phase power protection unit with flexible operating modes suitable for Data Centre facilities, as manufactured by Schneider Electric. The unit provided shall, as a minimum, meet the specification of the Schneider Electric 500 kW to 1500 kW, Galaxy VX product range. The unit provided shall have flexible operating modes, including ECOnversion™, and deliver very high efficiency even at very low load levels. The unit shall have the following characteristics, namely: ❑ Innovative four-level inverter reduces losses and component stress, leading to higher efficiency and component reliability ❑ Configurable internal redundancy provides a fault-tolerant design ❑ A 110% continuous-duty static switch provides robust overload capabilities ❑ Flexible energy storage solutions, including support for lithium-ion batteries ❑ Fully rated system with kVA = kW at 40 °C ❑ Modular, scalable, and redundant configurations, to adapt to real facility needs ❑ Modular fault-tolerant power blocks reduce mean time to repair ❑ Smart Power Test (SPoT) mode, to test the UPS at the site without the need to rent a load bank before connecting to real load ❑ Built-in back-feed protection providing human safety and compliance ❑ Scale the system power as load demands increase by adding 250 kW power cabinets after initial installation ❑ Scale the system for capacity or redundancy ❑ The power factor correction and harmonics filtering at input must eliminate the oversizing of the upstream infrastructure ❑ Color touch-screen display with a separate mimic diagram		A C E L M S

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The unit shall have a modular design such that system may be scaled using 250 kW power cabinets. It must be possible to add the power cabinets after the initial installation of the unit such allowing for load growth or increased redundancy. The unit shall have three modes of efficiency, each having a unique combination of efficiency and performance, namely: 1) ECOnversion mode ○ Ultra high efficiency up to 98.8% ○ Keeps excellent load protection ○ Programmable for specific day and time periods for better flexibility ○ Continuously charges batteries ○ Compliant with IEC 62040-3 Class 1 output voltage of UPS standard ○ Input power factor correction and low input harmonics ○ No-break transfers ○ No drop of output voltage, even under low-impedance grid failure 2) Double conversion mode ○ High efficiency in double conversion online mode even at low load levels ○ Less energy losses = cost savings ○ Less heat dissipation = lower cooling needed, hence cost savings 3) ECO mode ○ Up to 99% efficiency ○ Compliant with IEC 62040-3 Class 3 output definition of UPS standard The unit shall have: ❑ Wide input voltage window and frequency ranges ❑ Genset compliant with adaptive ramp-in ❑ Integrated parallel capability with N+1 configurations ❑ Built-in integrated and tested back-feed protection for human safety and compliance ❑ Provides input power factor correction and harmonics filtering Integration into your facility infrastructure ❑ Compact footprint ❑ Back-to-back or against-the-wall installation - no rear clearance needed ❑ Operates at 40 °C continuously without de-rating ❑ Embedded seismic certified to IBC2012 and CBC2013 ❑ Low audible noise levels ❑ Replaceable dust filter for harsh environments ❑ Configurable input/output relays ❑ Top and bottom cable entry ❑ Parallel capability to increase capacity or redundancy ❑ External synchronization capability to support synchronized 2N configuration ❑ Flexible battery protection ❑ DC protection using breakers ❑ Centralized battery protection in a cabinet ❑ Multiple string-by-string battery protection ❑ Flexible energy storage ❑ Compatible with Li-ion , Ni-Cd, Flywheel, VRLA, and wet cells ❑ Flexible charging modes ❑ Ambient temperature charging current adaptation ❑ "GENSET" operation allows the trained user to limit charging current in order to avoid any upstream overload ❑ Temperature fault protection ❑ Different charging methods available i.e. floating, boost, equalization and cyclic ❑ Lithium-ion battery cabinet ❑ Rack based concept ❑ 3 layers of integrated Battery Monitoring System (BMS) ❑ Both voltage and current monitoring within each cartridge The unit shall also have a comprehensive Schneider Electric energy management solution for data centres. As mentioned under the clause, entitled "Proposed Bulk Electricity Service Connection", in an effort to reduce the initial construction cost, the Client / Employer has indicated that the initial electrical demand may be deemed as 360 kW (as opposed to the anticipated electrical load of 1080 kW). Therefore, the UPS unit (s) initially provided may be designed such that it (they) are servicing a 432 kW / 540 kVA electrical load, scalable to the 1296 kW / 1620 kVA electrical load in the future.		
9.7.14 Load Shedding / Load Curtailment The Buffalo City Metropolitan Municipality (BCMM) have recently directed that the East London Industrial Development Zone will no longer be exempt from any electrical load shedding implemented by themselves and / or Eskom. Furthermore, BCMM have directed the East London Industrial Development Zone begin participating in their (BCMM) electrical load curtailment programme. Therefore, it is imperative that all electricity users within the East London Industrial Development Zone comply with the requirement in that when directed to do so, they reduce their operating electrical load by 20 % of their base load, for the duration of the load shedding cycle. The electrical installation of the new Data Centre is to be designed such that participation in this electrical load curtail programme is possible.		
9.7.15 Main Low Voltage Panels / Electrical Distribution Boards All main low voltage panels and electrical distribution boards are to be manufactured by a reputable company, with relevant experience in the manufacturing of low voltage panels, electrical distribution boards, control panels, etc. Approval of the		A C E

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manufacturing company should be obtained from the Client / Employer prior to the placing of any orders / commencement of Works. Detailed wiring diagrams and shop (manufacturing) drawings of the proposed low voltage panels and electrical distribution boards are to be submitted to the Client / Employer for approval, prior to manufacture. Approval of the wiring diagrams and shop (manufacturing) drawings by the Client / Employer does not remove any responsibility from the Contractor to ensure the completeness and compliance of the low voltage panels and electrical distribution boards. The Contractor shall ensure that each low voltage panel and electrical distribution board is constructed to fit into the space provided, that sufficient space is allowed for the cable ends and termination thereof and that each board is provided with an architrave and a hinged lockable door. The low voltage panels and electrical distribution boards shall have a protection rating of no less than IP55. All gland plates, as well as top or side plates used for the termination of cables shall be easily removable to facilitate the drilling and punching of holes. Panels (fascia) and cover plates are to be fixed to the framework by means of "Quicklock" or other similar captive fasteners. Self-tapping screws or dome nuts will not be accepted. Panels (fascia) and cover plates are to be fitted with chrome plated handles to facilitate removal. Where applicable, the outer and inner frames and front panels of the respective sections shall be painted in the following distinctive colours, namely : ❑ Frame (Outer and Inner) - White - RAL 9010 (Pure White) ❑ Normal - White - RAL 9010 (Pure White) ❑ Essential - Orange - RAL 2004 (Pure Orange) ❑ Critical - Red - RAL 3020 (Traffic Red) ❑ Photovoltaic - Green - RAL 6037 (Pure Green) ❑ Un-interruptible - Blue - RAL 5005 (Signal Blue) Each section of the low voltage panel and electrical distribution board shall be provided with a legend cardholder with a clear perspex front. Each circuit breaker shall be clearly numbered in accordance with the single line diagrams. Corresponding numbers and circuit descriptions shall be clearly typed on the legend cards. All main switches shall be clearly marked "MAIN SWITCH" and the necessary warning labels are to be installed at the switch. Each low voltage panel and electrical distribution board shall have sufficient ways for each circuit neutral and each circuit earth wire. Doubling up of circuits w.r.t terminations will not be accepted. Particular note shall be taken of the fault current requirements of each low voltage panel and electrical distribution board electrical distribution board. Unless otherwise stated, low voltage panels and electrical distribution boards shall be rated for a minimum fault current rating of 5 kA. The following tests shall be carried out on the low voltage panels and electrical distribution boards by the appointed Contractor (or their appointed manufacturing company), prior to installation thereof, namely: ❑ high voltage test of 2 000 V, 50 Hz, tested for 1 minute per phase to earth (with remaining phases earthed) ❑ a 1 000 V Megger test on all insulated sections between phases and between phases and earth (resistance readings not to exceed 1 000 Mega ohms) ❑ full operational tests of all control circuits, relays and switchgear ❑ a trip test of all earth leakage relays, creating an earth fault on each of the protected circuits ❑ a current injection trip test on all main breakers to ensure that they trip at their set currents Proof of these tests, and the results thereof, shall be issued to the Client / Employer for approval, prior to dispatch of the low voltage panels and electrical distribution boards to site. As is required by the desired Tier Certification and Accreditation, each Data Centre Hall, and similar room, within the Data Centre shall be serviced by means of a dual, redundant and ring-fed low voltage configuration. In other words, each Data Centre Hall (and similar room) shall be equipped with a low voltage electrical distribution board which is serviced from, and protected by, the medium voltage and low voltage equipment emanating from Substation A and from Substation B, hereinafter The low voltage electrical distribution boards shall be configured such each data rack within the respective Data Centre Halls (and similar rooms) is serviced within electricity supply from "service A" and from "service B".		L M S
9.7.16 Conduit and Conduit Accessories All flush-mounted conduit and conduit accessories shall be PVC conduit in accordance with SANS 950. All surface-mounted conduit and conduit accessories shall be galvanised conduit type, and manufactured in accordance with SANS 162, 763 and 1007 respectively. The Contractor shall ensure that conduit installation shall, wherever possible, be installed within the ceiling voids / roof space. Wherever necessary, the services shall be chased, or cast into, the concrete slabs and brick walls. Should flush mounting not be practical (or possible), the Contractor shall obtain prior approval from the Client / Employer, for the installation of surface mounted conduit and / or accessories. If approved, surface mounted conduits shall be installed using galvanised spacer brackets, allowing a clear space of 25 mm. Conduit accessories shall be mounted on similar brackets, ensuring an aesthetic installation. All exposed conduit and conduit accessories shall be galvanised, powder coated, orange.		A C E L M S
9.7.17 Conductors All low voltage single core conductors shall be of the PVC insulated type with stranded copper conductors, rated at 600 V general service duty and manufactured in accordance with SANS 1507 - 1990. The colour coding for the PVC insulation shall be: ❑ red, white and blue for phases ❑ black for neutral ❑ green and / or yellow for earth The Contractor shall be allowed to utilise "twin and earth" or "surfix" type conductors. Single core conductors shall only be installed within conduits, wiring ducts or channels. No single core conductors will be permitted in open channels, or on cable trays and / or cable ladders.		A C E L M S

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"Twin and earth" or "surfix" conductors shall only be installed within conduits, wiring ducts or channels, or on cable trays and / or cable ladders. The drawing in of more than two circuits per conduit shall not be allowed.		
9.7.18 Lighting Installations A lighting installation, in accordance with the relevant regulations, which will ensure the efficient and proper usage of all spaces throughout the new buildings, shall be provided. All luminaires specified shall be fitted with light emitting diode-type lamps. The lighting design calculations shall be based on achieving the minimum lighting levels, in accordance with the relevant South African National Standards documentation, as follows: ❑ Manufacturing - General Working Areas (*) - 350 lux ❑ Administrative Buildings - Entrance Halls - 100 lux ❑ - Reception Areas - 100 lux ❑ - Board rooms, offices - 300 lux ❑ - Computer rooms - 500 lux ❑ Maintenance Buildings - General - 300 lux The lighting design shall (where applicable) take into account and include the following, namely: ❑ Specified luminaires shall provide high levels of luminous flux and be fitted with electronic control gear ❑ Specified lamps shall provide the correct colour rendering for the application and use energy efficient lamps i.e. light emitting diode (LED) type ❑ Maximum natural daylight usage and controllable light levels ❑ Task specific light sources ❑ Multiple control for light circuits / zones covering areas greater than 100 m² Emergency exit signage and route lighting shall be provided for any evacuation procedures that could occur. Light outlet points shall be installed as symmetrical as possible within the area in which they are fitted. Cognisance must be taken of the finishes and structural components to avoid clashes of services. Ceiling mounted fluorescent fittings shall be secured to the concrete ceiling by means of expansion bolts, or "Hilti" fixings, and to the ceiling boards by means of galvanised "Butterfly" expansion nuts. The Contractor is to include in the Tender Price the provision of additional fixing materials, where needed. Allowances shall be made for decorative post-top type luminaires, with light emitting diode type lamps, on fibreglass poles to be installed throughout the complex including along all walkways, roadways and parking areas. Light switches shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. Light switches shall be installed at 1 400 mm AFFL. All lamp types shall be guaranteed for the full duration of the guarantee period and / or the stipulated lamp life, as stated by the Lamp Manufacturers, whichever is the greater. The Contractor shall, upon completion of the Contract, issue to the Client / Employer, for their maintenance purposes, sufficient spare lamps. All external lighting circuitry shall be controlled by means of photo-electric daylight switches.		A C E L M S
9.7.19 Schedule of Luminaires All luminaires shall comply fully with the specifications detailed herein. The Contractor is to make allowance for the provision of sample luminaires for approval by the Client / Employer, prior to the placement of orders. The Contractor is to ensure that sufficient time is allowed for the approval process. The luminaires, as approved by the East London Industrial Development Zone, shall comply with the following : Type 1 - LED Panel - 600 x 600 - 32 W, as offered by Beka Schréder (Pty) Ltd Name : LED Panel Manufacturer's code : LED Panel - 600 x 600 - 32 W General description : Recessed LED Panel Mounting method : Recess in-lay into 600 mm x 600 mm wide T-bar ceiling grid Dimensions : 595 mm x 595 mm x 10.5 mm Gear Compartment : IP20 Lamp Compartment : IP20 Battery Compartment : IP20 Lamps General : Osram Colour : 6500 K, 80 CRI Efficacy : 100 lumens per watt Working life : L70, 30 000 hours Dimming facilities : Non-dimmable Driver General : Osram Input voltage : 220 VAC - 240 VAC Power factor : 0.95 Total harmonic distortion : < 20% Surge protection : No Accessories : 3 m 5 A cabtyre plug top Battery type : Nickle metal hydride Battery housing : Integral with luminaire		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Operating temperatures : -10 - 40 degrees Warranty : 5 Year Warranty Comply Type 2 - LLSA / GLL L-bay / 2 x 81 W / 5700 K, as offered by LED Lighting SA (Pty) Ltd Name : GLL - Lbay Manufacturer's code : LLSA / GLL L-bay / 2 x 81 W / 5700 K General description : 2 x 81 W, Linear Lowbay Luminaire Mounting method : Surface mounted Dimensions : 1435 mm (l) x 155 mm (w) x 50 mm (h) Housing General : High Grade Aluminum, powder coated white or black wit acrylic lenses. Conformal coated PCB's suitable for corrosive environment. Stainless steel gear tray and screws, Aluminum end caps, see attached Cenrtonal specification sheet Gear Compartment : The power supply enclosure within the control gear compartment, which has an IP 20 rating, may be rated at IP65 Lamp Compartment : Conformal-coated LED PCBs suitable corrosive environment. IP20 enclosure Battery Compartment : The power supply enclosure within the control gear compartment, which has an IP 20 rating, may be rated at IP65 Diffuser : Acrylic lense diffuser, highly effective, anti corrosive and suited to coastal environment, impact resistant. Lamps General : Osram high powered, high efficacy, low consumption LED Colour : White, 5700 K, 80 CRI Efficacy : 180 lumens per Watt LED efficacy at 150 mA operating current Working life : L70, > 100 000 hours Dimming facilities : Non-dimmable Driver General : Tridonic Driver Input voltage : 198 VAC - 264 VAC Power factor : >0.95 Total harmonic distortion : <10% Surge protection : 10 kV (replaceable, installed in DB per circuit) Accessories : 3 m 5 A cabtyre plug lead 3 pin socket (standard luminaire), 3 m 5 A cabtyre plug lead 4 pin socket (emergency luminaire) Emergency General : 10% of luminaire output for 3 hours Battery type : Nickle Metal Hydride Battery housing : Integral with luminaire General Certificates : SABS / IEC 60598-2-1 , SABS / IEC 60598-1 Operating temperatures : 0 degree Celsius to +40 degree Celsius Warranty : 5 year, full replacement, irrespective of problem experienced Replacement components : Power supply unit, optics, batteries, control gear Manufacturing lifespan : Luminaire will be in production for no less than 10 years Type 3 - LLSA / VP2 - 43 W, as offered by LED Lighting SA (Pty) Ltd Name : Vapour Proof luminaire Manufacturer's code : VP2 - 43 W General description : Vapour Proof surface mounted luminaire Mounting method : Surface mounted onto any surface Dimensions : 1277 mm x 101 mm x 101 mm Gear Compartment : IP66 Lamp Compartment : IP66 Battery Compartment : N/A Lamps General : Osram Colour : 5700 K, 80 CRI Efficacy : 180 lumens per watt Working life : L70, 54 000 hours Dimming facilities : Dali / 0 - 10V Driver General : Tridonic Input voltage : 110 VAC - 220 VAC Power factor : 0.95 Total harmonic distortion : < 20% Surge protection : No Accessories : 3 m 5 A cabtyre plug top Battery type : N/A Battery housing : N/A Operating temperatures : -20 degree Celsius to +40 degree Celsius Warranty : 5 Year Type 3 - LLSA / VP2 - 43 W (Emergency), as offered by LED Lighting SA (Pty) Ltd Name : Vapour Proof Luminaire Manufacturer's code : VP2 - 43 W General description : Vapour Proof surface mounted luminaire		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Mounting method : Surface mounted onto any surface Dimensions : 1277 mm x 101 mm x 101 mm Gear Compartment : IP66 Lamp Compartment : IP66 Battery Compartment : IP66 Lamps General : Osram Colour : 5700 K, 80 CRI Efficacy : 180 lumens per watt Working life : L70, 54 000 hours Dimming facilities : Dali / 0 - 10V Driver General : Tridonic Input voltage : 110 VAC - 220 VAC Power factor : 0.95 Total harmonic distortion : < 20% Surge protection : No Accessories : 3 m 5 A cabtyre plug top Battery type : Nickle Cadium Battery housing : Integral with luminaire Operating temperatures : -20 degree Celsius to +40 degree Celsius Warranty : 5 Year Type A - LLSA / DL-D - 170mm- 16 W, as offered by LED Lighting SA (Pty) Ltd Name : LED Down lighter Manufacturer's code : DL-D - 170mm- 16 W General description : Recessed LED down lighter Mounting method : Recess into ceiling grid or cut into skimmed ceiling Dimensions : 190 mm x 84 mm Gear Compartment : IP20 Lamp Compartment : IP20 Battery Compartment : N/A Lamps General : Osram Colour : 5700 K, 80 CRI Efficacy : 103 lumens per watt Working life : L70, 50 000 hours Dimming facilities : Non-dimmable / Dali / Triac / 0-10V Driver General : Tridonic / TCI / Vossloh-Schwabe Input voltage : 110 VAC - 230 VAC Power factor : 0.95 Total harmonic distortion : < 11% Surge protection : Yes, 2kV Accessories : 3 m 5 A cabtyre plug top : Occupancy Sensor (group control) : Tridonic ConnecDim Battery type : N/A Battery housing : N/A Operating temperatures : -20 degree Celsius to +40 degree Celsius Warranty : 5 Year Type A - LLSA / DL-D - 170mm- 16 W (Emergency), as offered by LED Lighting SA (Pty) Ltd Name : LED Down lighter Manufacturer's code : DL-D - 170mm- 16 W General description : Recessed LED down lighter Mounting method : Recess into ceiling grid or cut into skimmed ceiling Dimensions : 190 mm x 84 mm Gear Compartment : IP20 Lamp Compartment : IP20 Battery Compartment : IP20 Lamps General : Osram Colour : 5700 K, 80 CRI Efficacy : 103 lumens per watt Working life : L70, 50 000 hours Dimming facilities : Non-dimmable / Dali / Triac / 0-10V Driver General : Tridonic / TCI / Vossloh-Schwabe Input voltage : 110 VAC - 230 VAC Power factor : 0.95 Total harmonic distortion : < 11% Surge protection : Yes, 2kV Accessories : 3 m 5 A cabtyre plug top		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
: Occupancy Sensor (group control) : Tridonic ConnecDim Battery type : Nickle metal hydride Battery housing : Exterior with the driver Operating temperatures : -20 degree Celsius to +40 degree Celsius Warranty : 5 Year Type B - Beka Nova LED - 35W, as offered by Beka Schréder (Pty) Ltd Name : Factory Flood light Manufacturer's code : Beka Nova LED - 35W General description : Surface mounted floodlight Mounting method : Surface mount Dimensions : 440 mm x 378 mm x 217 mm Gear Compartment : IP66 Lamp Compartment : IP66 Battery Compartment : N/A Lamps General : Vossloh-Schwabe Colour : 4000 K, 70 CRI Efficacy : 153 lumens per watt Working life : L70, 100 000 hours Dimming facilities : Non-dimmable Driver General : Osram Input voltage : 210 VAC - 240 VAC Power factor : 0.90 Total harmonic distortion : < 11% Surge protection : 11kV, external to driver Accessories : Daylight switch mini Battery type : N/A Battery housing : N/A Operating temperatures : -20 degree Celsius to +45 degree Celsius Warranty : 5 Year *(Please note that this luminaire may be substituted with an alternative Beka product. We await further communication from the ELIDZ in this regard.)* Type B - Beka Nova LED - 35W (Emergency), as offered by Beka Schréder (Pty) Ltd Name : Factory Flood light Manufacturer's code : Beka Nova LED - 35W General description : Surface mounted floodlight Mounting method : Surface mount Dimensions : 440 mm x 378 mm x 217 mm Gear Compartment : IP66 Lamp Compartment : IP66 Battery Compartment : IP66 Lamps General : Vossloh-Schwabe Colour : 4000 K, 70 CRI Efficacy : 153 lumens per watt Working life : L70, 100 000 hours Dimming facilities : Non-dimmable Driver General : Osram Input voltage : 210 VAC - 240 VAC Power factor : 0.90 Total harmonic distortion : < 11% Surge protection : 11kV, external to driver Accessories : Daylight switch mini Battery type : Ni-Cd Battery housing : Internal with luminaire, 5W built in LED with up to 3Hr backup Operating temperatures : -20 degree Celsius to +45 degree Celsius Warranty : 5 Year *(Please note that this luminaire may be substituted with an alternative Beka product. We await further communication from the ELIDZ in this regard.)* Type C - Beka Series 42 LED, Black, Opaque - 9W, as offered by Beka Schréder (Pty) Ltd Name : Walkway luminaire Manufacturer's code : Beka Series 42 LED, Black, Opaque - 9W General description : Surface mounted general light Mounting method : Surface mount Dimensions : 341 mm x 195 mm x 105 mm		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Gear Compartment : IP65 Lamp Compartment : IP65 Battery Compartment : N/A Lamps General : Vossloh-Schwabe Colour : 4000 K, 80 CRI Efficacy : 153 lumens per watt Working life : L70, 60 000 hours Dimming facilities : Non-dimmable Driver General : Tridonic / TCI Input voltage : 210 VAC - 250 VAC Power factor : 0.90 Total harmonic distortion : < 11% Surge protection : Yes, 2kV Accessories : Battery type : N/A Battery housing : N/A Operating temperatures : -20 degree Celsius to +35 degree Celsius Warranty : 3 Year Type C - Beka Series 42 LED, Black, Opaque - 9W (Emergency), as offered by Beka Schréder (Pty) Ltd Name : Walkway luminaire Manufacturer's code : Beka EM-Series 42 LED, Black, Opaque - 9W General description : Surface mounted general light Mounting method : Surface mount Dimensions : 341 mm x 195 mm x 105 mm Gear Compartment : IP65 Lamp Compartment : IP65 Battery Compartment : IP65 Lamps General : Vossloh-Schwabe Colour : 4000 K, 80 CRI Efficacy : 153 lumens per watt Working life : L70, 60 000 hours Dimming facilities : Non-dimmable Driver General : Tridonic / TCI Input voltage : 210 VAC - 250 VAC Power factor : 0.90 Total harmonic distortion : < 11% Surge protection : Yes, 2kV Accessories : Battery type : Ni-Cd (1 hour backup) Battery housing : Integral with luminaire Operating temperatures : -20 degree Celsius to +35 degree Celsius Warranty : 3 Year Type D - Beka LEDduo / Square, Pearl Light Grey - 2 x 7W, as offered by Beka Schréder (Pty) Ltd Name : Staircase luminaire Manufacturer's code : Beka LEDduo / Square, Pearl Light Grey - 2 x 7W General description : Surface mounted square staircase light Mounting method : Surface mount Dimensions : 262 mm x 121 mm x 81 mm Gear Compartment : IP65 Lamp Compartment : IP65 Battery Compartment : IP65 Lamps General : Bridgelux Colour : 4000 K, 80 CRI Efficacy : 125 lumens per watt Working life : L70, 50 000 hours Dimming facilities : Non-dimmable Driver General : Tridonic / TCI / Osram Input voltage : 198VAC - 250 VAC Power factor : 0.95 Total harmonic distortion : < 11% Surge protection : Yes, 2kV Accessories : Battery type : N/A Battery housing : N/A Operating temperatures : -20 degree Celsius to +35 degree Celsius Warranty : 3 Year		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Any, or all, of the above-mentioned luminaires may be utilised in the design of the lighting installation.		
9.7.20 Small and Large Power Installation Generally, power shall be provided to the various areas by means of switched socket outlets. The layout and quantity of the switched socket outlets shall be determined by the use of the specific room, the equipment to be installed therein and the services / activities to be rendered from there. Switched socket outlets shall be provided approximately every 10 m² in all passages and public areas for cleaning and maintenance purposes. Should the activity or specific equipment require, i.e. within the kitchen areas, the power supply provided shall be in the form of a switched isolator. As the design responsibility ends at the switched socket outlet or isolator points, we cannot guarantee what the End User is going to connect to the installation. Therefore, it is only possible to encourage (and not guarantee) energy savings at switched socket outlet and isolator points. All small and large power outlet points shall be installed as symmetrical as possible within the area in which they are fitted. Cognisance must be taken of the finishes and structural components to avoid clashes of services. The Contractor is to include in the Tender Price the provision of additional fixing materials, where needed. Small and large power outlets shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. Small power outlet points shall be installed at 400mm AFFL. Large power outlet points shall be installed at 1,400mm AFFL, complete with a 50mm diameter round conduit box at 300mm AFFL and a conduit "link" in between, or as is necessary for the connection to the relevant electrical equipment. Where applicable, small and large power outlets shall be colour-coded as follows: ❑ normal power outlets, white ❑ essential power outlets, red ❑ uninterruptible power outlets, blue Where applicable, small power outlets shall be equipped as follows: ❑ normal power outlets, round earth pin ❑ essential power outlets, 0 degree shaven earth pin ❑ uninterruptible power outlets, 45 degree shaven earth pin		A C E L M S
9.7.21 Power Skirting Installation The power skirting, where applicable, shall be O-Line Premier Skirt PM2, a fully modular system, manufactured from self-extinguishing polycarbonate, with a white finish white in colour, complete with all necessary accessories, corner pieces, covers, dividers, elbows, end caps, joint clips, outlet clips, tee pieces, etc. All electrical outlets installed within the power skirting shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. matching those supplied as small power outlets. The power skirting installation shall be executed in a manner acceptable to the Client / Employer. The jointing of lengths shall be kept to an absolute minimum, but should they be necessary all joints / ends are to be "machine cut" and completed with a neat and flush finish. The power skirting installation shall be complete with all standard accessories, i.e. flexible covers, flexible partitions, variable internal dividers and angles, variable external angles and angle covers, flat angles, endcaps, front and base cover joints, tee junctions, etc. The power skirting shall be (approximately) 195 mm high x 50 mm deep, allowing two x 65 mm high covers (top and bottom channels) and one x 40 mm high cover (middle channel). The top channel will be for the normal power services, the bottom channel for the essential and uninterruptible power services and the middle channel for the data and telephone services. The middle channel; is to be fitted with a partition, allowing separation between the data and telephone services cabling.		A C E L M S
9.7.22 Power Pole Installation The power poles, where applicable, shall be a fully modular system, manufactured from aluminum, with telescopic ceiling mounting devices, protective end caps and white PVC covers i.e. the O-Line power pole range, as manufactured by O-Line. The power pole installation shall be complete with all standard accessories i.e. ceiling jacks, ceiling flanges, outlet kits, PVC covers, base plates, etc. All electrical outlets installed within the power poles shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. matching those supplied as small power outlets. The power poles shall be sized to accommodate the floor to ceiling height of the room in which they are installed.		A C E L M S
9.7.23 Flush-floor / Under-screed Ducting Installation Where applicable, the flush-floor ducting and under-screed ducting systems shall be fully modular, manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut. The flush-floor ducting system shall be complete with all standard accessories i.e. ducts, draw-boxes, splices, power skirting connectors, pedestal conduit boxes, pedestals, etc. The under-screed ducting system shall be complete with all standard accessories i.e. ducts, draw-boxes, splices, conduit access floor outlet kits, concrete ingress prevention plate, plastic carpet frame and lid, etc. All electrical outlets installed within the flush floor / under-screed ducting system shall be Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. matching those supplied as small power outlets.		A C E L M S
9.7.24 Cable Support Systems *Cable Ladder* Where applicable, the cable ladder shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. The cable ladder shall be of a weld-free construction, allowing fitment on site. No alternatives shall be accepted.		A C E

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
The cable ladder shall be complete with all standard accessories i.e. height reducing, width reducing and adjustable splices, radiused bends, 90 degree droppers, 90 degree risers, horizontal crossovers, horizontal tees, etc. The cable ladder shall be supported on unistrut, suspended from the roof trusses / roof slab by means of suitably-sized galvanised steel threaded rods. *Cable Tray* Where applicable, the cable tray shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. The cable tray shall be of an inward bend return flange construction, allowing the use of thinner gauge materials, without compromising loading or deflection standards. No alternatives shall be accepted. The cable tray shall be complete with all standard accessories i.e. height reducing, width reducing and adjustable splices, fishplate couplers radiused horizontal bends, internal elbow (droppers), internal elbow (risers), variable internal riser and external dropper, 4-way crossovers, horizontal tees, covers, dividers, etc. The cable tray shall be supported on unistrut, suspended from the roof trusses / roof slab by means of suitably-sized galvanised steel threaded rods. *General* All exposed cable support systems shall be powder coated, orange.		L M S
9.7.25 Wiring Duct Installation Where applicable, the wiring duct shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. No alternatives shall be accepted. The wiring duct shall be complete with all standard accessories i.e. PVC covers, splices, radiused and non-radiused internal and external elbows (bends), radiused and non-radiused, horizontal elbows (bends), tee-offs, cross-overs, etc. The wiring duct shall be supported on unistrut, suspended from the roof trusses / roof slab by means of either galvanised steel threaded rods and / or stainless steel hangers. The wiring duct shall be of the suitably sized to accommodate the installed services and have sufficient spare capacity for the installation of future services. All exposed wiring duct shall be powder coated, orange.		A C E L M S
9.7.26 Wiring Mesh Installation Where applicable, the wiring mesh shall be manufactured from pre-galvanised steel (grade Z275), as manufactured by Cabstrut or O-Line. No alternatives shall be accepted. The wiring mesh shall be complete with all standard accessories i.e. splices, radiused and non-radiused internal and external elbows (bends), radiused and non-radiused, horizontal elbows (bends), tee-offs, cross-overs, etc. The wiring mesh, if suspended, shall be supported on unistrut, suspended from the roof trusses / roof slab by means of either galvanised steel threaded rods and / or stainless steel hangers, or if wall mounted, secured to the wall by means of unistrut, splice clamps, washer and a M6 x 16 cup square bolt and nut arrangement. The wiring mesh shall be of the suitably sized to accommodate the installed services and have sufficient spare capacity for the installation of future services. All exposed wiring mesh shall be powder coated, orange.		A C E L M S
9.7.27 Earthing (Bonding), Specialist Earthing, Surge Protection and Lightning Protection Systems *Earthing (Bonding) System* The Contractor shall be responsible for the supply and installation of the required earthing (bonding) system. The earthing (bonding) system shall comply with SANS 0142 - 1987 and shall comprise a continuous main copper earth bar together with connections to all items of electrical, electronic and mechanical equipment. Bonding of the earth system to metal work in buildings, concrete reinforcing, roofs or pipework, etc. shall also be supplied under this Contract. The clamping surfaces of all connections shall be properly tinned to prevent oxidation. Where earthing conductors are run on walls or vertical surfaces they shall be secured by "stand-off" bolted saddles at intervals not exceeding 1 250 mm. Earth electrodes to be supplied and installed under this contract shall consist of 16 mm diameter extensible molecular bonded copper clad steel rods 1 800 mm long, complete with coupling and terminal. These electrodes must comply with SANS 0163 - 1985. *Specialist Earthing* The Contractor shall be responsible for the supply and installation of the specialist earthing system. A general description of the minimum requirement of the specialist earthing system is as follows : The specialist earthing system shall comprise insulated 70 mm² copper wire, terminating onto insulated equipotential busbars, interconnected to earth mats and / or earth stars. A minimum of four insulated equipotential busbars, which are for the equipotential bonding of all data and telecommunications equipment, shall be positioned within each Data Centre Hall, or similar room. Similar insulated equipotential busbars shall be provided adjacent each telephone and data board. The insulated equipotential busbars shall comprise a copper bar with snap-on terminals suitable for solid and stranded conductors, fitted to a UV stabilised, insulated frame and shall be used to bond all manufacturing equipment. The specialist earthing conductor shall be installed in 20 / 25 mm galvanised conduit, complete with all necessary conduit accessories. The galvanised conduit shall be secured to the structural steel structure by means of "beam clip / snap-in conduit combination" unit (in the horizontal plane, where out of reach from day-to-day operations) and by means of galvanised, stand-off (hospital) saddles, in the vertical plane).		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Where applicable, the galvanised conduit saddles, earth bars, etc. are to be secured to the structural steel columns by using a "Hilti", or similar and approve, screw. All Works affecting the structural steel columns shall be approved by the Consulting Structural Engineer, prior to the commencement thereof. The respective equipotential busbars shall be inter-connected, in a dual / redundant manner, by means of 70 mm² bare copper earth wire, terminating onto an earth mat (or earth mat per building component), constructed from 70 mm² bare copper earth wire, placed in a crisscross arrangement, spaced at intervals not more than 300 mm apart, with all intersections / cross-overs, etc. cad-welded. A minimum of two corners of each earth mat shall be connected to the lengths of 70 mm² bare copper earth wire en route to the respective earth bars. The earth mats, where applicable, shall be sized to suit the application and shall be manufactured from lengths of 70 mm² bare copper earth wire, placed in a crisscross arrangement, spaced at intervals not more than 300 mm apart, with all intersections / cross-overs, etc. cad-welded. A minimum of two corners of each earth mat shall be connected by means of lengths of 70 mm² bare copper earth wire to an earth bar. The earth star systems, where applicable, shall comprise a 5 metre three point star electrode system, with two 70 mm² bare stranded copper conductors, fitted to earth spikes with a crimped lugs, an a three point electrode system, comprising 1.7 m x 16 mm² electrodes, connected with 70 mm² bare copper earth wire. The earth resistance of the respective earth bars, earth mats and earth star systems shall not exceed 30 ohms and shall be supplemented as necessary with driven molecular bonded copper clad steel rods manufactured to SANS 0163 - 1985. Separate earth mats / systems shall be provided for the following facilities / areas, (where applicable), namely: ❑ Substations, Medium Voltage Switch Rooms, Transformer Rooms, Low Voltage Switch Rooms, Generator Installations ❑ Uninterruptible Power Supply Installations, etc. ❑ Telecommunications / Data Server Rooms / Data Centre Halls *Surge Protection System* The Contractor shall be responsible for the supply and installation of the required surge protection equipment. All low voltage panels and electrical distribution boards are to be fitted with surge protection, as is required by the relevant regulations. *Lightning Protection System* The Contractor shall be responsible for the supply and installation of the required lightning protection system, protecting all buildings within the Data Centre. The lightning protection system shall be installed in accordance with the relevant South African National Standards documentation and shall comprise (per building) : ❑ An air termination system installed on all parapet walls / exposed elements ❑ A down-conductor system installed within wall cavities, or surface mounted, whichever is necessary ❑ A down-conductor bonded to earth termination system ❑ Ground earth electrodes ❑ An earth termination system The lightning protection system shall consist of 20 mm x 3 mm flat aluminium conductor and / or 12 mm round aluminium conductor, complete with stand-off type saddles.		
9.8 Staff Training		
The Contractor shall provide comprehensive training of male and female operational staff and nominated maintenance personnel, to the approval of the Client / Employer. Training shall be comprehensive, covering all aspects of systems installed as part of these Works. The Contractor shall provide a detailed training programme and a copy of the training documentation to the Client / Employer, for comment and review, no less than 4 weeks prior to the commencement of training. No training will commence on site prior to the written approval of the Client / Employer. Should the Client / Employer not approve the training programme and documentation, the training programme and documentation will be referred back to the Contractor for re-evaluation and re-submission to the Client / Employer. The number of staff to be trained is to the full discretion of the Client / Employer. However, the Contractor shall allow for 4 groups, each of up to 4 personnel. Each group shall receive a minimum of two 2-hour training sessions. One of these sessions shall be held prior to the commissioning of the electrical engineering services installation, and the other of these sessions, upon expiry of the defects liability period. Training shall be adequate to ensure that the groups trained are: ❑ competent in the operation of systems ❑ adequately trained to carry out on-going training ❑ fully aware of the location of all equipment installed as part of this Contract within their area of responsibility The names of personnel attending the training shall be recorded and submitted to the Client / Employer at the conclusion of training. Maintenance staff shall demonstrate a complete understanding of the location and connectivity of the various elements of the electrical engineering services installation. All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on site by the Client / Employer.		A C E L M S
9.9 Drawings		
The following drawings have been attached to this documentation: ❑ 2019-348 / DC 0 - 000 Proposed Services Building (Option 1) Revision 0		A C E

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
		L M S
10 DATA AND TELECOMMUNICATIONS		
10.1 Design Criteria and Parameters		
The design criteria applied to the electrical engineering services shall include the following, namely: ❑ Capital costs ❑ Operational and maintenance requirements and costs ❑ Ease of functionality, operation and maintenance ❑ Compliance with general energy efficiency and / or sustainability standards Furthermore, the electrical engineering services shall be designed in accordance with, but not limited to, the current versions of the following, namely: ❑ the South African National Standard : Code of Practice for "The Application of the National Building Regulations" i.e. those included in the "National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977)", as published in the Government Gazette, number 31084, dated 30 May 2008, which became effective as of 01 October 2008, and known as "SANS 10400 - 2010" ❑ the Occupational Health and Safety Act, 1993 (Act 85 of 1993), ❑ SANS 204-1 : 2008 - Energy Efficiency in Buildings : Part 1 - General Requirements, ❑ SANS 204-2 : 2008 - Energy Efficiency in Buildings : Part 2 - The Application of the Energy Efficiency Requirements for Buildings with Natural Environmental Control, ❑ SANS 204-3 : 2008 - Energy Efficiency in Buildings : Part 3 - The Application of the Energy Efficiency Requirements for Buildings with Artificial Ventilation or Air-conditioning, ❑ any other relevant by-laws of the Local Authorities, ❑ SANS 507-1 : (NRS 034-1 : 2007) Electricity Distribution - Guidelines for the Provision of Electricity Distribution Networks in Residential Areas (Part 1 : Planning and Design of Distribution Networks) ❑ SANS 10114-1 : 2005 : Interior Lighting ❑ South African National Standard : SANS 10142-1: 2003 - The Wiring of Premises : Part 1 - Low-voltage Installations All apparatus, components, parts, fittings and materials supplied and / or installed, whether specifically specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate current South African (SANS) or British Standard Specifications (BS) and Addenda thereto, except where otherwise required by this specification or permitted by approval of the Client / Employer, in writing. All materials and workmanship, which may, in the opinion of the Client / Employer, be inferior to that specified for the Work, will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the satisfaction of the Client / Employer. Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful completion of the installation is to be included so as to form a complete working installation.		A C E L M S
10.2 Building Classification		
The buildings shall be classified as follows, namely: ❑ Offices — "G1 : Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage" ❑ Data Centre Halls — "D4 : Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Utility Rooms — "D4 : Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Gate House — "G1 : Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage" ❑ Generator / Diesel Storage — "D4 Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" and "J1 High Risk Storage", with the definition "Occupancy where material is stored and where the stored material is liable, in the event of a fire, to cause combustion with extreme rapidity, or give rise to poisonous fumes, or cause explosions"		A C E L M S
10.3 Definitions		
❑ Design — To create a plan or a specification for the construction of a system, or for the implementation of an activity or a process ❑ Supply — To purchase, procure and deliver complete with all related specified accessories ❑ Erect — To place or mount and fix in position ❑ Install — To erect, connect up and commission, complete with related accessories ❑ Indicated shown, Noted — As indicated or shown on drawings ❑ Approved, Alternative — Approved in writing by the Client / Employer ❑ Similar, Equal — Equal or better in efficiency of performance and compatibility		A C E L M S
10.4 Acceptance, Testing And Commissioning		
The Contractor shall allow for two representatives of the Client / Employer to participate in, and witness, all acceptance tests undertaken by the respective Manufacturers, for all major items of the security / telecommunications equipment i.e. but not limited to, booms, electrical fence, closed circuit television, intruder alarm, etc. The Contractor shall carry out all testing and commissioning required in terms of the respective Supplier specifications, relevant Acts, SANS Codes of Practice and Local Authority requirements. The Contractor shall provide all the equipment and apparatus required for the purpose of carrying out all necessary tests.		A C E L M

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
The Contractor is responsible for carrying out all necessary tests and obtaining / preparing / issuing all necessary certificates for the installation and operation of the plant. If any part of the Works fails the test, the Contractor shall be responsible for rectifying, at his own cost, the defective Works and the re-testing thereof to ensure compliance. If in consequence, the Client / Employer are obliged to attend the further acceptance tests the additional costs incurred by the Engineers shall be payable by the Contractor. The Works shall be deemed to be practically complete only when the Client / Employer has approved all tests and inspections, and a Completion Advice Notice or other relevant completion notice is issued.		S
10.5 Defects Liability Period		
The Contractor shall be responsible for the carrying out of inspections, services and maintenance-related tasks that are specified / recommended by the relevant Manufacturers / Suppliers for each component of the respective installations described herein, including but not limited to the following : General ❑ clean and wipe down all equipment ❑ carry out a visual inspection of complete installation to ensure that all fittings/devices are still in place, covers fitted properly, etc. Electric Fence ❑ check both live and earth circuits for continuity ❑ voltage test with certificate to be provided on each service ❑ earth spike ohms to be tested and recorded ❑ energizer to be opened and checked ❑ connections below the energizer to be checked and tightened ❑ riser poles with insulators to be washed with soapy water to remove salt build up ❑ all washed items to be rinsed with fresh water ❑ gate links and bridges to be tested ❑ all shrub and bush to be cleared from the bottom of the fence line ❑ approved weed treatment to be applied to base of the fence or apron ❑ relay connection to monitored alarm to be tested ❑ siren activation and response time from control room to be recorded ❑ GSM activation to be tested and remaining airtime balance to be recorded. ❑ all spring and tensioners to be retightened and checked ❑ verify that the fence voltage is correct ❑ battery voltage to be checked and recorded ❑ report any fault conditions. Access Control – Biometrics / Locking Devices ❑ check readers are seated and secured to the wall ❑ check all battery backed equipment and record charging and static current ❑ check and verify all alarms conditions ❑ record number of operations, where applicable ❑ check operation of locking devices ❑ verify that each cabinet is free of moisture and that all cooling equipment is operational ❑ print operating software for record purposes ❑ all equipment to be blown out and clear of any dust Access Control Booms ❑ check that all floor bolts are tight ❑ check isolator and power supply units, record the voltage ❑ grease lifting and lowering mechanism with approved lubrication ❑ check and test all loop detectors ❑ ensure lock out is fully functional ❑ check fire break or trigger from the fire detection system ❑ check control panel and test each trigger button ❑ ensure all wireless triggers are functional ❑ clean, wash and wipe outer housing of the booms Access Control Turn-Stile (Turn Star-Triumph 4 Double Turnstile) (including pedestrian gate) ❑ check that all floor bolts are tight ❑ check isolator and power supply units, record the voltage ❑ grease Turning mechanism with approved lubrication ❑ clean and wipe the 316 stainless steel ❑ ensure lock out is fully functional ❑ check fire break or trigger from the fire detection system ❑ check control panel and test each trigger button ❑ ensure all wireless triggers are functional ❑ clean, wash and wipe outer housing of the housing ❑ Disabled full height pedestrian gate		A C E L M S

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Security Intruder Alarm ❑ visual inspection of batteries ❑ test and check charge of the backup batteries ❑ computer download of the alarm system ❑ check and test all partitions ❑ test each zone independently ❑ check wireless devices and if necessary, replace all batteries ❑ check all bus lines inclusive of expanders ❑ check all expander batteries and power supply units. ❑ check and record battery voltages ❑ record battery voltage and current Closed Circuit Television ❑ check all settings on the recorder and ensure schedules are correct ❑ check and record if the recorder is recording ❑ focus, clean and reposition all cameras if necessary ❑ check each camera for motion settings and scheduling ❑ if applicable test and check dial in connection ❑ ensure control room viewing is active ❑ check switches, cabinets and cable trays ❑ each camera is to be washed, cleaned and dried ❑ focus, clean and reposition all cameras if necessary Data Network Installation / Internet Protocol Telephone Installation ❑ check all settings on the switches and ensure schedules are correct ❑ clean and wipe cabinets ❑ check battery backed equipment ❑ ensure handsets are all fully functional ❑ test each in and outgoing line ❑ focus, clean and reposition all cameras if necessary The Contractor shall ensure that the inspections, services and maintenance-related tasks are undertaken at intervals not greater than three months. The Contractor shall ensure that each inspection, service and / or maintenance-related task is undertaken in the presence of a representative of either the Client / Employer or the Client / Employer. The Contractor shall ensure that the necessary documentation is completed and submitted to the Client / Employer confirming the completion of the relevant tasks after every inspection, service and / or maintenance-related task milestone. The Contractor shall also timeously attend to any defects, which may occur through the normal operation of the Works. If, during the defects liability period, the installation is not in working order for any reason for which the Contractor is responsible, or if the respective installation develops a defect, the Contractor shall, immediately upon being notified thereof, take steps to remedy the defects and make any necessary adjustments. Should such stoppages, however be so frequent as to become troublesome, or should the installation otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Client / Employer, at his own expense replace the whole of the installation, or such parts thereof, as the Client / Employer may deem necessary with equipment specified by the Client / Employer. Upon completion of the defects liability period, the Client / Employer shall undertake the final inspection, service and / or maintenance-related task, as explained above and ensure that the necessary documentation is completed and submitted to the Client / Employer on behalf of the Client / Employer.		
10.6 Accreditation of Project		
It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility.		A C E L M S
10.7 Detailed Schedule of Work		
10.7.1 Proposed 3 m Perimeter Electric Fence It is anticipated that the Data Centre shall have a fence around the outer perimeter of the building. The electric wire fence and alarm system shall act as an electronic barrier to detect intrusion and report to the Control Room in the East London Industrial Development Zone. The electric wire fence system shall be installed as a stand-alone system located on the facility side of the inner perimeter fence. The electronic barrier shall consist of the following: ❑ A protective 3000 mm high barrier with 29 tensioned stainless steel protection wires, stretched between anchor posts, (wire tension shall be such that when a 2kg weight is applied between two slider posts the wire deflection shall be between 50 mm and 75 mm. ❑ All wires shall be of the same tension and supported by a number of springs and tensions.		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
❑ The fence shall be divided into zones or sections and shall be monitored separately. ❑ All corners shall be level and flush ❑ The electric wire sensors shall be mounted on a sensor post constructed of galvanized steel ❑ The electric wire sensors shall be spaced according to the wire spacing specification. ❑ Tensioners shall be galvanized, ratchet wheel type. ❑ At one end of the zone, each wire strand shall be attached to an individual tensioner. ❑ All slider post accessories shall be constructed of stainless steel. ❑ At a minimum, the sensor post accessories shall be constructed of galvanized steel as per detail in the drawings. ❑ Sensor, anchor and slider posts: All sections shall be at least 3000 mm in height. All posts shall be equidistant, between 3.5 to 4 m separation, depending on terrain and detection system requirements or as per spacing of the perimeter fence.		
10.7.2 Access Control – Bio metrics /Locking Devices Booms The access control system offered shall consist of a biometric-based system with fingerprint recognition being the primary identification method, and proximity / contactless card detection as the secondary means of identification. The system shall provide a fast, accurate and versatile solution capable of managing a minimum of 20,000 users. The access control system shall record all movements and activities at each control point. The access control terminals shall be vandal resistant in construction and shall be capable of being mounted either indoors or outdoors. Furthermore, the access control terminals shall incorporate both finger recognition and proximity/ contactless card recognition within a single housing.By default, fingerprint matching shall be utilised for identification, and only in cases where a user's fingerprint cannot be captured, shall a proximity or contactless card be used. The access control terminals shall be able to connect directly onto an Ethernet-type network and shall be capable of operating in a standalone configuration, without the need for a separate field controller. The terminal shall provide the necessary on-board secure input / output points necessary to control and monitor a single door. The access control terminal shall consist of an embedded real time device with on-board database management, including the ability to configure and process daily, weekly, monthly and holiday schedules. Anti-pass back management can either be a function of the respective access control terminals or via the access control system. In the event of an emergency, the unlocking of a group of selected doors, by the security management system's control (work) stations, shall be possible. The access control system will be capable of providing a "guard tour function" using the access control terminals explained above. The access control system shall include double Turnstar Triumph 4 316 Stainless full height turnstiles, at the gate house. All turnstiles shall be equipped with vandal resistant, weatherproof access control terminals on each side of the turnstile, which shall be linked with the access control system and security management system. Auto gate 318 stainless steel housing, single phase, red and white boom gates shall be equipped with vandal resistant, weatherproof access control terminals on the incoming side of the boom gate, which shall be linked with the access control system and security management system. Control panel mounted on a 316 stainless pre manufactured mounting plate shall be mounted Presence and exit loops shall be provided per boom. The loops shall be spaced adequately to avoid cross activation and interference.		A C E L M S
10.7.3 Intruder Security Alarm An intruder security alarm system shall be installed throughout the entire facility. The system shall consist of passives, exterior beams, door switches, control panels and battery backed power supply units. The main panel shall be installer-friendly complete with 18 Ampere-hour battery backup and battery charging unit. The main panel shall carry out automatic "self-testing" at regular intervals and report devices requiring attention. The intruder alarm panel will receive signals from various items of the installation, passives, expander units, magnetic switches and sounders/sirens which will be supplied and installed to the various areas being constructed and added to the building. All items included in the zones shall be wired with cable specified. The installation shall include for block diagrams and operating instruction to be installed alongside the panel in a position approved by the Client / Employer. Full training in the operation of the panel must be provided to all responsible persons and various levels of password access must be included for to disallow tampering of the programming and operation of the alarm panel. All sensors installed, shall be digital type with a quad zone logic and spherical lens supporting selectable pulse counts and built-in LED indicator. The bases shall be surface mounted or ceiling mounted where applicable and the detectors shall have a twist and lock action for installation. All sensors and bases shall be clearly labeled with an address number and be located as per the drawings provided. The sensors provided must have the following characteristics, namely: ❑ Digital indoor and outdoor technology ❑ RFI protection ❑ Intruder anti-tamper and zone control ❑ 12 m x 12 m range ❑ Small pet immunity and selectable pulse count ❑ All sensors are to be hard wired to the relevant panels or expanders Sensors in the ceiling voids shall have remote LED indicators. All remote LED indicators shall be labeled with the address of the sensor it is representing. All sensors must have dust covers until building activity ceases and the system is operational. The sounders shall be hard wired. The sound levels for the sounders shall comply with the standard specifications. Internal sounders shall be ceiling mounted and external sounders shall be weatherproof and wall mounted. All sounders must have dust covers until building activity ceases and the system is operational.		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
The panic buttons shall be hard wired units (manual call points) and are to be surface mounted in practical positions throughout the Data Centre facility. They shall be clearly marked as "emergency". All panic buttons must be fitted with a plastic cover to deter hoax alarm signals. Each unit shall be mounted with screws and correctly fixed. The plug-in expanders shall be installed in a suitable housing within the ceiling void, and have electronically-supervised power supply units for short and open circuits. They shall have capabilities of 8 zones and the function of reporting AC fail and restore, low battery, auxiliary fuse failure and restore. The strobe warning light shall be ceiling mounted with a shallow base and have electronically-supervised power supply units for short and open circuits. They shall have a red lens suitable for internal or external operation, flashing energy of 0.5 Joules and compliant with relevant safety and installation standards. The RS 485 bus isolator shall provide protection against surges and power fluctuation. All batteries shall be 18 Ampere-hour type with suitable charging units and placed within a suitable metal housing. All keypads shall have a liquid crystal display and a backlit keypad. The keypad shall be capable of displaying the zone description list. The keypad shall have keypad tone and volume adjust, programmable zone input per keypad, programmable zone output per keypad, "stay, buzz and chime profiles" easy cross partitioning with ability to arm and disarm entire system. The remote LED shall be blue in colour indicating the status of the intruder alarm panel (or sub-panels, if applicable). The remote shall be able to identify the user and have the ability to arm and dis-arm the relevant alarm panel. The cabling utilized between alarm panels shall be Mylar type 1.0 mm² and between alarm panels and devices as recommended by the relevant Supplier. All magnetic switches shall be able to monitor the status of a normally closed or normally open circuit. They shall be white in colour and be fastened by screws only. The central control unit (control panel) be capable of : ❑ offsite monitoring ❑ interface to / with GSM service modules ❑ reporting to local authority (ies)		
10.7.4 Closed Circuit Television A closed circuit television (CCTV) system shall be installed throughout the entire Data Centre facility. The system shall consist of IP cameras, internet protocol-based video encoders, video decoders, network video recording servers and associated hardware, software and cabling. The CCTV system shall generally comprise the following camera types, namely: ❑ Camera Type 1 (Direct IP Enabled Vandal Proof Fixed Dome Camera) i.e. this type of camera shall generally be installed within the various buildings, passage ways and covered structures / ports ❑ Camera Type 2 (Direct IP Enabled Vandal Proof Fixed Bullet Camera With Dynamic Range) i.e. this type of camera shall generally be installed in areas with variable lighting conditions and in areas where simultaneous low light and highlight areas exist ❑ Camera Type 3 (Covert PIR Camera with Audio) i.e. this type of camera shall be installed in areas that require the monitoring of staff and visitor activity All externally-mounted cameras shall be converted to fibre optic transmission to eliminate damage as a result of surge voltages, and to overcome the maximum transmission range of Ethernet (100 m) In addition to the in-built motion detection function specified for all cameras and video encoders, cameras mounted externally including those monitoring the perimeter fence, shall be equipped with intelligent video motion detection (IVMD) hardware / software, in order to eliminate false motion alarms. Once movement has been detected, the object shall be highlighted and motion thereof shall be tracked. If an object and its motion match any of the defined conditions, it shall create an alarm condition, enabling an automated response to other sub-systems. An internet protocol-based video recording system shall be provided whereby all images are stored on digital video recording servers installed within the various Control / Server Rooms in the facility. The CCTV system shall generally comprise two (2) off high resolution 22" LCD-type monitors placed at each control (work) station within the various Control / Server Rooms.		A C E L M S
10.7.5 Internet Protocol Telephone/Data Network Installation		
10.7.5.1 Telephone System The Client / Employer shall appoint a Specialist Telephone Service Provider for the installation of the telephone system. The Contractor shall allow for the complete installation of all conduits, outlet boxes, distribution boards, etc., required for the telephone system. The telephone distribution boards, where applicable, shall be practically positioned. The distribution board must be suitably sized, complete with a single hinged door and a 20 mm thick wooden backboard, flush mounted at a minimum 1 200 mm above floor level. All conduits installed for the telecommunications installation shall be minimum 25 mm in size and in struct accordance with the above clause explaining "conduit and conduit accessories". Polyester draw-wires shall be installed in all conduits. Flush mounted end boxes must consist of a 100 mm (h) x 100 mm (w) x 50 mm (d) outlet box fitted with suitable blank cover plates, flush mounted 300 mm above floor level, or as otherwise indicated on the construction drawings. All telephone outlets installed shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. matching those supplied as small power outlets. The telephone outlets shall be fitted with the modular 6-way, 4-contact telephone socket, complete with shutter. Where possible, the two-module grid, either two telephone sockets, or a combination of telephone and data sockets, may be utilised.		A C E L M S
10.7.5.2 Data System The Client / Employer shall appoint a Specialist Data Service Provider for the installation of the data system.		A C

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
The Contractor shall allow for the complete installation of all conduits, outlet boxes, distribution boards, etc., required for the data system. The data distribution boards, where applicable, shall be practically positioned. The distribution board must be suitably sized, complete with a single hinged door and a 20 mm thick wooden backboard, flush mounted at a minimum 1 200 mm above floor level. All conduits installed for the data installation shall be minimum 25 mm in size and in struct accordance with the above clause explaining "conduit and conduit accessories". Flush mounted end boxes must consist of a 100 mm (h) x 100 mm (w) x 50 mm (d) outlet box fitted with suitable blank cover plates, flush mounted 300 mm above floor level, or as otherwise indicated on the construction drawings. All data outlets installed shall be of the Crabtree Diamond Range, a fully modular system comprising a strong, universal steel support frame, an easy clip-on assembly and a white screwless cover plate complete with all necessary accessories, clip-on covers, etc. matching those supplied as small power outlets. The data outlets shall be fitted with the modular 6-way, 4-contact telephone socket, complete with shutter. Where possible, the two-module grid, either two data sockets, or a combination of data and telephone sockets, may be utilised.		E L M S
10.7.5.3 Combined Network A high speed 1GB high speed Ethernet network shall be supplied, installed and commissioned by the contractor, which shall provide system networking for the telephone and the data installation. It is a specific requirement that all sub-system hardware shall interface either directly or by means of IP converters within the local equipment room in each building. All communications between buildings shall be IP based. The LAN shall be installed in a star topology with the star point being situated at the most centrally located Server Equipment room in the facility. Each local equipment room shall be equipped with a sufficient number of 24 port 10/100 Layer 3 Managed PoE Ethernet switches with a minimum of two 1GB uplink ports. Sufficient Switches shall be provided to enable the termination of all 10/100 devices provided. The 1 GB Uplink ports shall be networked via fiber optic and terminated into a 24 port 10/100/1000 Layer 2 Switch. The contractor shall supply and install all cables, enclosures, switches and any other components to make the system complete.		A C E L M S
10.7.5.4 Termination of Cables Cable ends shall be terminated with glands or in cable boxes with the associated accessories such as clamps, shrouds, etc. in a manner recommended by the manufacturer. At every cable termination, the cable shall be looped in the ground to allow for future re-making of the termination, should this become necessary. Correctly-sized lugs shall be crimped onto the ends of the cable using the correctly-sized hexagonal crimping tool. The lug hole size shall match that of the termination bolts. A pre-stretched tube or heat shrink tube shall be placed over the end lug and switchgear spout to completely insulate the termination. Taping of the end lug shall not be allowed. Cable end boxes shall be installed, as specified, to prevent mechanical damage or access to the terminals. Cable end boxes shall not be filled with any type of filling compound.		A C E L M S
10.7.5.5 Testing Each cable shall be tested after installation thereof to ensure proper functionality. All tests shall be recorded on the associated terminal equipment and in the Record Drawings. The Contractor shall notify the Client / Employer timeously, so that their representative may witness the tests. On completion of the tests, the Contractor shall submit three copies of the certified test reports to the Client / Employer.		A C E L M S
10.7.5.6 Conduit / Cable Tray / Trunking All exposed air-conditioning and ventilation-related electrical conduit / cable tray / trunking shall be galvanized, orange powder-coated, including relevant bushes, locknuts, couplings, galvanized saddles, etc. Conduit and conduit accessories / cable support systems / wire duct and mesh installations shall comply with the requirements as detailed in the Electrical Specification.		A C E L M S
10.7.5.7 Cable Markers The cable markers shall consist of a concrete block in the shape of a truncated pyramid, approximately 300mm deep x 150mm x 150mm at the top and 230mm x 230mm at the bottom. An aluminium indicator plate shall be cast onto the top of the marker. Indicator plates shall have the following inscriptions: ❑ CABLE / CABLE SLEEVES ❑ INDICATE NUMBER AND SIZE Markers for cable joints shall have the following stamped inscription on the indicator plate: ❑ CABLE JOINT No Markers shall be placed at regular intervals along the cable routes, approximately 50 meters apart and also at all changes in direction with arrows indicating route of cable. A sample of the proposed markers shall be submitted to the Client / Employer for approval before they are manufactured. The position of the cable markers shall be indicated on the Record Drawings.		A C E L M S
10.7.5.8 Crossing of Existing Services The Contractor shall acquaint himself with all services that are existing and to be maintained to ensure that any excavations he may undertake will not damage or hinder such services or expose his work to possible damage by others. The Contractor will be held responsible for damage to any existing or concurrently installed service, which might be brought to his attention by the relevant authority and shall be held responsible for the cost of any repairs.		A C E L M

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		S	
10.7.5.9 Builder's and Related Works The Contractor shall be responsible for the necessary co-ordination and timing of the builder's and related Works pertaining to this Contract. All Utility Rooms shall be constructed with the necessary floor trenches for the installation of all associated mechanical services.		A C E L M S	
10.7.5.10 Trench Excavations The Contractor shall undertake all trench excavations, including backfilling and compaction, required for the electrical installation. Where possible, all routes should be either parallel or perpendicular to the nearest building and / or structure, maintaining a minimum distance of 0.5 mm from the edge of the foundation of the boundary wall and or building walls. The Client / Employer should be notified immediately should any deviations to the routes be required. The cable-trenches shall be excavated to a depth of 600 mm deep below ground level and shall be 500 mm 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. The bottom of the trench shall be level and clean and the bottom and sides free from rocks or stones liable to cause damage to the cable. The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage. In the trenches the cables shall be laid on a 75 mm thick bed of earth and be covered with a 150 mm layer of earth before the trench is filled in. Trenches are to be backfilled and consolidated in stages (150 mm intervals) to prevent subsequent subsidence. Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150 mm. The surface is to be made good as required. All compactions shall be to Mpa density of 93% AASHTO density. Any subsidence, either during the construction period, or the guarantee period, shall be remedied. The backfilling of all post-mounted, or similar, luminaires shall be done with a 10 : 1 sand / cement mix.		A C E L M S	
10.7.5.11 Brick-built Enclosures (Manholes) The Contractor shall be responsible for the provision of the brick-built enclosures (manholes). The manholes shall be constructed on a mass concrete Class D base, 150 mm thick and projecting 150 mm all way round, and comprise two-brick thick walls, plastered internally, and fitted with a (minimum) 600 mm diameter, heavy duty, Type 8UA frame and lid. The Contractor is to ensure that all manholes are waterproofed.		A C E L M S	
10.7.5.12 Ducts The Contractor shall be responsible for the provision of all ducts necessary for the electrical and, telecommunications and associated installations. In summary, ducts shall be installed beneath (across) all walkways, driveways, and finished surfaces. The ducts shall be manufactured from a high-density polyethylene with a double wall construction, allowing a corrugated outer wall finish and a smooth inner wall finish, and of the internal diameters as indicated on the attached drawings. All ducts shall be minimum 100 mm outer diameter, with minimum 87 mm internal diameter. Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in high-density polyethylene pipes. The ends of all ducts shall be sealed with a non-hardening watertight compound after the installation of cables. All ducts intended for future use shall be sealed.		A C E L M S	
10.7.5.13 Access Floor The Contractor shall be responsible for the provision of all raised access floors within the respective Data Centre Halls, Meet Me Rooms, etc. The access floor shall be utilized for the purposes of reticulating and distribution the various electrical, mechanical and telecommunications systems into the respective Data Centre Halls, Meet Me Rooms, etc.		A C E L M S	
10.8 Staff Training			
The Contractor shall provide comprehensive training of male and female operational staff and nominated maintenance personnel, to the approval of the Client / Employer. Training shall be comprehensive, covering all aspects of systems installed as part of these Works. The Contractor shall provide a detailed training programme and a copy of the training documentation to the Client / Employer, for comment and review, no less than 4 weeks prior to the commencement of training. No training will commence on site prior to the written approval of the Client / Employer. Should the Client / Employer not approve the training programme and documentation, the training programme and documentation will be referred back to the Contractor for re-evaluation and re-submission to the Client / Employer. The number of staff to be trained is to the full discretion of the Client / Employer. However, the Contractor shall allow for 4 groups, each of up to 4 personnel. Each group shall receive a minimum of two 2-hour training sessions. One of these sessions shall be held prior to the commissioning of the electrical engineering services installation, and the other of these sessions, upon expiry of the defects liability period.		A C E L M S	

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Training shall be adequate to ensure that the groups trained are: ❑ competent in the operation of systems ❑ adequately trained to carry out on-going training ❑ fully aware of the location of all equipment installed as part of this Contract within their area of responsibility The names of personnel attending the training shall be recorded and submitted to the Client / Employer at the conclusion of training. Maintenance staff shall demonstrate a complete understanding of the location and connectivity of the various elements of the electrical engineering services installation. All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on site by the Client / Employer.		
11 DESIGN – MECHANICAL ENGINEERING SERVICES		
11.1 Design Criteria and Parameters		
The design criteria applied to the mechanical engineering services shall include the following, namely: ❑ Capital costs ❑ Operational and maintenance requirements and costs ❑ Ease of functionality, operation and maintenance ❑ Compliance with general energy efficiency and / or sustainability standards Furthermore, the mechanical engineering services shall be designed in accordance with, but not limited to, the current versions of the following, namely: ❑ the South African National Standard : Code of Practice for "The Application of the National Building Regulations" i.e. those included in the "National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977)", as published in the Government Gazette, number 31084, dated 30 May 2008, which became effective as of 01 October 2008, and known as "SANS 10400 - 2010" ❑ the Occupational Health and Safety Act, 1993 (Act 85 of 1993), ❑ SANS 204-1 : 2008 - Energy Efficiency in Buildings : Part 1 - General Requirements, ❑ SANS 204-2 : 2008 - Energy Efficiency in Buildings : Part 2 - The Application of the Energy Efficiency Requirements for Buildings with Natural Environmental Control, ❑ SANS 204-3 : 2008 - Energy Efficiency in Buildings : Part 3 - The Application of the Energy Efficiency Requirements for Buildings with Artificial Ventilation or Air-conditioning, ❑ South African National Standard : SANS 10142-1: 2003 - The Wiring of Premises : Part 1 - Low-voltage Installations ❑ the current version of the South African Bureau of Standards : Code of Practice for "Automatic Sprinkler Installations for Fire Fighting Purposes", Edition 1 : 2000, which became effective as of 17 March 2000, and known as "SABS 0287 - 2010", together with subsequent amendments ❑ the current version of the South African Bureau of Standards : Code of Practice for "Water Supplies and Drainage for Buildings – Part 1 : Water Supply Installations for Buildings", Edition 2.1 : 2004, and known as "SANS 10252 -1 : 2004", together with subsequent amendments ❑ the current version of the South African Bureau of Standards : Code of Practice for "Fire Detection and Alarm Systems for Buildings - System Design, Installation and Servicing", Edition 3.2 : 2012, and known as "SABS 10139 - 2012", together with subsequent amendments ❑ the current version of the South African Bureau of Standards : Code of Practice for "Fire Protection for Electronic Equipment Installations", Edition 2 : 2015, and known as "SANS 246 - 2015", together with subsequent amendments ❑ the current version of the South African Bureau of Standards : Code of Practice for "the Operation of Fire Protection Measures Part 1 & 2 : Gaseous Extinguishing Systems", known as "SANS 369", together with subsequent amendments ❑ the current version of the South African Bureau of Standards : Code of Practice for "Gaseous Fire-Extinguishing Systems", known as "SANS 14520", together with subsequent amendments ❑ any other relevant by-laws of the Local Authorities. All apparatus, components, parts, fittings and materials supplied and / or installed, whether specifically specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate current South African (SANS) or British Standard Specifications (BS) and Addenda thereto, except where otherwise required by this specification or permitted by approval of the Client / Employer, in writing. All materials and workmanship, which may, in the opinion of the Client / Employer, be inferior to that specified for the Work, will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the satisfaction of the Client / Employer. Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful completion of the installation is to be included so as to form a complete working installation.		A C E L M S
11.2 Building Classification		
The buildings shall be classified as follows, namely: ❑ Offices — "G1: Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage" ❑ Data Centre Halls — "D4: Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Utility Rooms — "D4: Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" ❑ Gate House — "G1: Offices", with the definition "Occupancy comprising offices, banks, consulting rooms and other similar usage"		A C E L M S

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❑ Generator / Diesel Storage — "D4Plant Rooms", with the definition "Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building" and "J1 High Risk Storage", with the definition "Occupancy where material is stored and where the stored material is liable, in the event of a fire, to cause combustion with extreme rapidity, or give rise to poisonous fumes, or cause explosions"		
11.3 Definitions		
❑ Design — To create a plan or a specification for the construction of a system, or for the implementation of an activity or a process ❑ Supply — To purchase, procure and deliver complete with all related specified accessories ❑ Erect — To place or mount and fix in position ❑ Install — To erect, connect up and commission, complete with related accessories ❑ Indicated shown, Noted — As indicated or shown on drawings ❑ Approved, Alternative — Approved in writing by the Client / Employer ❑ Similar, Equal — Equal or better in efficiency of performance and compatibility		A C E L M S
11.4 Acceptance, Testing and Commissioning		
The Contractor shall allow for two representatives of the Client / Employer to participate in, and witness, all acceptance tests undertaken by the respective Manufacturers, for all major items of the mechanical equipment i.e. but not limited to, air-conditioning, ventilation, CRAC / chiller / DX systems, fire detection / suppression systems, integration between electrical and mechanical systems, etc. The Contractor shall carry out all testing and commissioning required in terms of the mechanical equipment Supplier specifications, relevant Acts, SANS Codes of Practice and Local Authority requirements. The Contractor shall provide all the equipment and apparatus required for the purpose of carrying out all necessary tests. The Contractor is responsible for carrying out all necessary tests and obtaining / preparing / issuing all necessary certificates for the installation and operation of the plant. If any part of the Works fails the test, the Contractor shall be responsible for rectifying, at his own cost, the defective Works and the re-testing thereof to ensure compliance. If in consequence, the Client / Employer are obliged to attend the further acceptance tests the additional costs incurred by the Engineers shall be payable by the Contractor. The Works shall be deemed to be practically complete only when the Client / Employer has approved all tests and inspections, and a Completion Advice Notice or other relevant completion notice is issued.		A C E L M S
11.5 Defects Liability Period		
The Contractor shall be responsible for the carrying out of inspections, services and maintenance-related tasks that are specified / recommended by the relevant Manufacturers / Suppliers for each component of the respective installations described herein, including but not limited to the following : General ❑ clean and wipe down all equipment ❑ carry out a visual inspection of complete installation to ensure that all equipment / fittings are still in place, covers fitted properly, etc. Air-conditioning and Ventilation : ❑ check system functions for normal operations ❑ check air filters and change if dirty ❑ check that electrical loads drawn are within normal parameters ❑ using manual control, check the operation of the refrigeration circuit ❑ check hydraulics / pumps of chiller system ❑ check water level and any leaks of the chiller system ❑ check CRAC system is operating correctly including humidifier ❑ ensure that there are no signs of ice formation on the evaporator coils ❑ inspect all fuses and thermal overload devices ❑ ensure that there are no obstructions in the path of the air supply to and from the unit ❑ check the condensate pipe for blockages ❑ check the operation of the compressor / chiller and consumption of current is normal ❑ inspect the fan motor(s) and bearings and condenser coil, cleaning dirt from between fins if necessary ❑ check fan speed ❑ ensure display panel lights and/or controls are functioning correctly ❑ inspect fans, check that direction of rotation is correct and that bearings are not running hot ❑ check mains voltage ❑ check the surface temperature of the compressor housing ❑ check insulation on tubing / piping Early Warning Detection and Alarm : ❑ check control equipment ❑ check system functions for normal operations ❑ check fire brigade signalling (if applicable) ❑ check GMS signalling (check numbers provided are still correct) ❑ check all lamps in visual indicators and control desk ❑ check all audible alarms and fire evacuation speech system (if applicable) ❑ check battery, electrolyte level of accumulators and charging unit		A C E L M S

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❑ check random detectors and end of line units for operation ❑ detection circuit is to be tested each 3 monthly service and each detector tested is to be logged on a maintenance sheet in order to ensure that within a 6 month period every detector will have been tested ❑ ensure display panel lights and/or controls are functioning correctly ❑ test the interface controls with other services Fire Protection : ❑ check system functions for normal operations ❑ check pressure gauges and that the pressure is correct ❑ check that all equipment has been serviced within the applicable service interval and correctly displayed on relevant service labels ❑ where applicable, carry out relevant servicing of equipment and update relevant service labels ❑ each unit serviced is to be logged on a maintenance sheet in order to ensure that within a twelve (12) month period all equipment is serviced Fire Suppression : ❑ check control equipment ❑ check system functions for normal operations ❑ check fire brigade signalling (if applicable) ❑ check GMS signalling (check numbers provided are still correct) ❑ check all lamps in visual indicators and control desk ❑ check all audible alarms and fire evacuation speech system (if applicable) ❑ check battery, electrolyte level of accumulators and charging unit ❑ check all detectors, aspirators (particle count) and end of line units for operation ❑ detection circuit is to be tested each 3 monthly service and each detector tested is to be logged on a maintenance sheet in order to ensure that every detector will have been tested ❑ ensure display panel lights and/or controls are functioning correctly ❑ test the interface controls with other services ❑ check gas storage cylinders, solenoids and pressure gauges to make sure the system is at its optimum ❑ room integrity test to be undertaken The Contractor shall ensure that the inspections, services and maintenance-related tasks are undertaken at intervals not greater than three months. The Contractor shall ensure that each inspection, service and / or maintenance-related task is undertaken in the presence of a representative of either the Client / Employer or the Client / Employer. The Contractor shall ensure that the necessary documentation is completed and submitted to the Client / Employer confirming the completion of the relevant tasks after every inspection, service and / or maintenance-related task milestone. The Contractor shall also timeously attend to any defects, which may occur through the normal operation of the Works. If, during the defects liability period, the installation is not in working order for any reason for which the Contractor is responsible, or if the respective installation develops a defect, the Contractor shall, immediately upon being notified thereof, take steps to remedy the defects and make any necessary adjustments. Should such stoppages, however be so frequent as to become troublesome, or should the installation otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Client / Employer, at his own expense replace the whole of the installation, or such parts thereof, as the Client / Employer may deem necessary with equipment specified by the Client / Employer. Upon completion of the defects liability period, the Client / Employer shall undertake the final inspection, service and / or maintenance-related task, as explained above and ensure that the necessary documentation is completed and submitted to the Client / Employer on behalf of the Client / Employer.		
11.6 Accreditation of Project		
It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility.		A C E L M S
11.7 Detailed Schedule of Work		
11.7.1 Air-conditioning and Ventilation Services		
11.7.1.1 VRV Air-conditioning System (Office Area) The Main Office-related Building shall be provided with a Daikin VRV heat-recovery type air-conditioning system. The air-conditioning system shall be an air cooled, VRV type multi heat recovery system consisting of one outdoor unit and multiple indoor units per zone, each unit or groups of units having capability to control heating or cooling independently to suit the requirements of the rooms. *a) Air-conditioning Indoor Units (Office Area)* Indoor units shall be of the ceiling mounted cassette (600 x 600 mm where possible), in-ceiling ducted, or wall mounted type. They shall have electronic control valves, which control refrigerant flow rate in response to load variations of the room.		A C E L M S

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The fans shall be of the multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation. The address of the indoor unit shall be set automatically in case of individual and group control. In the case of a centralized control, it shall be set by liquid crystal remote controller. *b) Air-conditioning Outdoor Units (Office Area)* The outdoor units shall be factory-assembled units housed in sturdy weatherproof casings constructed from rustproofed galvanized steel panels coated with a baked epoxy powder finish. The units shall each have a minimum of two scroll compressors and be able to operate even when one of the compressors is out of order. The noise level shall not be more than 60 dB (A) at normal operation measured horizontally 1 m away and 1.5 m above ground. The outdoor unit shall be equipped with a night quiet mode. The compressor shall be of highly efficient hermetic scroll type and equipped with inverter control capable of changing the speed in accordance to the cooling or heating load requirement. The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fin coil. The aluminium fins shall be covered by anti-corrosion resin film. External condenser units shall have a secondary corrosion resistant protection coating (Blu-chem or similar approved). The refrigerant circuit shall include liquid and gas shut off valves and a solenoid valves. All necessary safety devices shall be provided to ensure the safety operation of the system. The units shall be fitted with high pressure switch, overload relay, inverter overload protector and fusible plugs as safety devices. The unit shall be equipped with an oil recovery system to ensure stable operation with long refrigerant piping runs. *c) Air-conditioning Controls (Office Area)* Air-conditioning units shall be controlled by means of hard-wired controllers. The controllers shall be mounted adjacent the light switch position in the respective rooms. Wired remote type computerized PID controllers shall be used to maintain correct room temperatures and interrogate the system log. Units shall be equipped with a self-diagnostic and logging system for easy and quick maintenance and service. The LCD {Liquid Crystal Display) remote controllers shall memorize the latest malfunction code for easy maintenance, it shall be able of controlling up to 16 indoor units and change fan speeds individually in the group.		
11.7.1.2 Chilled Water System (Data Center Halls / Meet-Me / Utility Rooms) The above rooms shall be provided with a chilled water type air-conditioning system. As is required by the desired Tier Certification and Accreditation, the Data Centre shall be serviced by means of a bulk air-conditioning system which has a dual, redundant and ring-fed capacity and configuration. *a) Air-conditioning Indoor Units (Data Center Halls / Meet-Me / Utility Rooms)* Air-conditioning shall be a chilled water system with internal variable speed control air-handling cabinets (CRAC Units), with dual redundancy allowance, including but not limited to: ❑ leak sensors ❑ temperature and humidity control and monitoring (sensors positioned in return air duct) ❑ high efficiency filtration ❑ high energy efficiency ❑ rotation / back-up / auxiliary functions between cabinets ❑ room design set point = 22 ˚C ±1 ˚C (20 - 25 ˚C) and 55 Relative Humidity with set point stability ❑ self-regulating control : the automatic controller varies the air handling fan speed depending on the room's load or the pressure drop in the raised floor / dirty filter ❑ networked control devices to enable information to be fed back to the building monitoring system ❑ the entire air-conditioning system shall meet the requirements of a Tier III Classification The CRAC unit shall supply into the floor void of the respective room and shall supply the room through natural anodized aluminium floor louvers (foot traffic) in front of the data racks (angled towards the data rack). The return air shall be placed within the hot aisle, extracting through natural anodized aluminium return air grilles, into a ducted system within the ceiling void to the CRAC unit. Note: Utility rooms do not have a floor void and therefore the design is to take this into consideration wrt requirements. The system is to be a quite running system and shall not exceed 40 db in a 3m radius. *b) Air-conditioning Indoor Unit Control (Data Center Halls / Meet-Me / Utility Rooms)* The system shall be controlled by the temperature and humidity control sensors. The control panel shall reflect that the system is healthy, and where faults have occurred, display the fault and sound an alarm. Possible faults, but not limited to: ❑ High / Low Room Temperature ❑ High / Low Humidity ❑ Filter Status (Dirty) ❑ Chilled Water No-flow Alarm ❑ Air Flow Alarm ❑ Floor Void Water Leak Detection ❑ Power interruption ❑ Fire Alarm		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
A Building Management System (BMS) is to be supplied to the building and shall be integrated to the control panel (BACnet IP / MSTP Compatible), and in the case of a failure, the alarm / failure etc. shall be displayed on the monitored computer within the Security Control Office. The control panel shall be integrated to the early warning detection and alarm installation and fire suppression system for each respective room. In a fire incident the air-conditioning system is to shut down. The unit shall be fully fail safe with the following protection, but not limited to: ❑ heat overload ❑ phase-failure for three phase equipment ❑ voltage drop or power interruption ❑ UPS Emergency Power Supply With any fault / failure, the system will restart automatically once the fault / failure has been rectified. *c) Air-conditioning Outdoor Units (Data Center Halls / Meet-Me / Utility Rooms)* The outdoor / condenser units shall be air cooled chillers designed / sized to cater for a Tier III Classification, including an integrated pump set operating in duty and standby complete with all control's electrical switchgear and safety switches. Pumps shall be close coupled with lifetime seal and are to be represented by a local supplier for availability of spare parts. Alternatively, the contractor supplier is to keep an inventory of pump spares. Where required, the chiller shall include a chilled water buffer tank and expansion vessel. The chiller shall be supplied with a flow switch, installed wired and factory tested, and shall be interlocked into the pump control logic. The compressors and refrigeration components shall be readily accessible for servicing without restricting condenser air flow or removal of condenser airflow affecting panels. The unit shall be fully fail safe with the following protection on each compressor, but not limited to : ❑ over / under voltage ❑ over amperage ❑ phase-failure for three phase equipment ❑ motor winding thermistors The certified operating range for ambient condition shall be between -15 to +50 without fault or modification. Pressure vessels shall be manufactured under PED or ASME pressure vessel codes, and shall comply with the South African pressure vessel regulations, bear a nameplate and shall be supplied with manufacturing certificates as part of the chiller documentation. Where plate heat exchangers are supplied, the contractor shall supply a suitable strainer for each heat exchanger to protect the heat exchangers from blockage and damage. Strainers / filters are to be installed prior to filling the system and starting pumps. The pressure vessel shall be fitted with certified pressure relief valves on the high and low side of each circuit. *d) Air-conditioning Outdoor Unit Control (Data Center Halls / Meet-Me / Utility Rooms)* The chiller outdoor unit shall include a microprocessor controller to ensure acceptable operation of the unit, and accurate control of water temperature to within 1 ˚C of the setpoint. The controller shall be capable of the following: ❑ accepting a minimum of two setpoints from an external source by hardwire (Digital, 4-20mA or 0-10v) ❑ chilled water setpoint reset based on ambient air temperatures ❑ have an alarm history log, with symptom of trip and operating parameters at time of trip ❑ making use of pressure transducers to sense pressure, not perform temperature based calculations to indicate pressures High / low pressure safety switch devices are to be supplied as part of chiller package. The chiller controller is to have outputs and logic to control the chilled and condenser water pumps, including controlling the condensing pressure on split type applications. The controller is to be fitted with BMS communication capability on RS 485 using LonWorks, Jbus, BACnet IP or Modbus. Voltage protection to be included in chiller electrical panel and shall provide protection from: ❑ high / Low voltage ❑ phase loss or reversal Voltage protection alarm to be automatic reset when electrical supply comes within normal limits of specified voltage. Each fan, pump and compressor contactor are to have an overload and circuit breaker installed. One circuit breaker for the entire panel is insufficient, as one circuit or item cannot be isolated. The chiller plant shall be managed by a system that will provide the following: ❑ chiller rotation based on run hours on a weekly basis ❑ base and swing strategy on larger plants where required ❑ chiller switching to match system load ❑ chiller fault recovery ❑ load limiting and load shedding ❑ secondary pump control ❑ cooling tower control ❑ thermal storage control The chiller plant management system shall have the following: ❑ remote access via GSM and web gate ❑ touch screen with Graphic display in plantroom area ❑ password protection and access level control ❑ trend Logging		

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❑ alarm log ❑ time of day Scheduling The chiller plant management system shall be capable of controlling the following type of plants : ❑ constant volume primary loop only ❑ decoupled / Primary secondary plants ❑ base and swing plants ❑ heat recovery and heat pump plant *e) Guarantee and Service (Data Center Halls / Meet-Me / Utility Rooms)* The Contractor's Manufacturer shall keep records of the equipment for the entire lifespan of the equipment. Spares shall be available from the Contractor's Manufacturer for 20 years from date of purchase. The Contractor's Manufacturer is to provide a complete spares list as part of the chiller documentation and shall keep stock (in South Africa) of the following minimum spares levels: ❑ all proprietary microprocessor units ❑ all pressure transducers and temperature sensors ❑ proprietary expansion valves and refrigeration components not available from general refrigeration wholesalers ❑ condenser fans Contractor suppliers capable of offering a 5 year comprehensive maintenance and guarantee will be considered. The Contractor's Manufacturer shall provide a 12 month standard parts and labour guarantee on the chiller package. This shall include three (3) inspection services and a handover at the end of the 12 month period. At the end of the guarantee period an oil analysis shall be performed by the Contractor's Manufacturer on each circuit and presented to the client for their records. If the oil is contaminated or unfit for further use, an oil change shall be completed on the chiller at no additional cost. On start-up, the Contractor's Manufacturer shall commission the chiller packages using their representatives to validate the guarantee. These representatives shall be certified and have undergone factory and advanced training on the chiller packages. Contractor's Manufacturers who can guarantee a next working day emergency call out response shall be considered. Manufacturers are to have two or more technical teams available at any time. The Contractor's Manufacturer is to install a remote monitoring facility by means of a GSM modem in the chiller packages for remote diagnostics and monthly logging during the guarantee period. The CRAC chilled water air-conditioning system shall be in accordance with Quality Management System ISO 9001. *f) Piping and Thermal Insulation (Data Center Halls / Meet-Me / Utility Rooms)* Only new black mild steel piping, to chiller manufacturer specifications, free from defects, rust, scale (inside and outside of piping) to be used. The Contractor is to flush and clean all new chilled water piping systems after the system has been successfully pressure tested. Chilled Water personnel shall witness the flushing and cleaning procedures. Flushing water and cleaning solutions shall be discharged to the sanitary sewer system. Piping insulation shall only be applied once all piping and equipment have been tested and approved. Any debris, oil, grease, rust, scale and dirt shall be removed from all surfaces by means of a suitable cleaning agent before the application of insulation. Pipes shall be painted with bitumastic paint before application of insulation. Type and thickness of the insulation is to be determined by the Contractor and shall be in accordance with Energy Efficiency Regulations, fire requirements when entering a new fire zone and as required by the chilled water system for an energy efficient system. The insulation including the adhesives and finishes shall be resistant to decay, mold, fungus growth or attack by vermin. The installation of the insulation shall be finished with a stainless steel sheet metal cover / wrapping around the piping, and the ends are to be formed in a triangle as to not to allow rain water to stand on the piping. Chilled water piping shall run within trenches (with removable galvanized steel lids for access) from the external chiller units to the Data Center Hall floor void. The piping shall be interconnected in such a manner that the air-conditioning system is installed to a Tier III Classification.		
11.7.1.3 Office Block Ventilation (Office Area) The air extract / supply ventilation systems shall be by means of ducted systems run within the ceiling void with axial extract / supply air fans securely mounted to the roof slab / trusses. The extraction / supply flow shall be calculated in terms of the stipulated minimum requirements in accordance with SANS 10400 "Part O" and the OHS Act w.r.t. the Environmental Regulations for Workplaces. The axial extract / supply fan shall either be a Silent Series type fan, or an axial extract fan including two off 1.5 D sound attenuators for a quite running system (45db). Ducting is to be galvanized un-insulated sheet metal inclusive of branch ducting and collars. All external ducting, fans, attenuators and fittings are to be corrosion resistant. Louvers shall be natural anodized aluminium weather louvers (color-coded to Principal Architect's specification). In the case of a fresh air system, washable filters are to be installed within respective plenum box. Ducting is to be connected to the disc valves located in ceiling using flexible ducting.		A C E L M S
11.7.1.4 Transformer Room Ventilation The air extract ventilation systems shall be by means of ducted systems with axial extract / supply air fans securely mounted to the roof slab / trusses. The extraction flow shall be calculated in terms of the stipulated minimum requirements in accordance with SANS 10400 "Part O", ASHRAE and the OHS Act w.r.t. the Environmental Regulations for Workplaces. The axial extract fan shall be a spark proof axial extract fan including sound attenuators for a quite running system (45db). The room shall be designed to have a temperature of approximately no more than 35˚C. Ducting is to be galvanized un-insulated sheet metal inclusive of branch ducting and collars. All external ducting, fans, attenuators and fittings are to be corrosion resistant.		A C E L M S

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Louvers shall be natural anodized aluminium weather louvers (color-coded to Principal Architect's specification). Ducting is to be connected to a galvanized steel canopy, including bird mesh, positioned above each respective transformer.		
11.7.1.5 Transformer Room Ventilation Control Panel The control panel will comprise an IP55 mild steel enclosure with orange powder coated finish. The control panel will have the following indication equipment for each fan: ❑ Power ON Indicator ❑ Fire Incident Indicator ❑ System Fault Indicator The control panel will be fitted with manual and automatic selector switches. The manual selector shall be used to override the system, and the automatic selector shall operate via a thermostat / temperature sensor positioned at high level. The control panel shall be used to operate the fans. The fans are to be switched off in the event of a fire, via a fire signal from the early warning detection and alarm and sprinkler systems.		A C E L M S
11.7.1.6 Conduit / Cable Tray / Trunking All exposed air-conditioning and ventilation-related electrical conduit / cable tray / trunking shall be galvanized, orange powder-coated, including relevant bushes, locknuts, couplings, galvanized saddles, etc. Conduit and conduit accessories / cable support systems / wire duct and mesh installations shall comply with the requirements as detailed in the Electrical Specification.		A C E L M S
11.7.2 Early Warning Detection and Alarm System The facility shall be equipped with an early warning detection and alarm installation, in accordance with the relevant South African National Standards documentation, comprising a Category L1 fire detection system. An analogue addressable control panel (Ziton to match existing systems) shall be provided within the facility, including the supply and installation of early warning detection devices (smoke sensitive, heat sensitive, combustion gas sensitivity and light emitting diodes), alarm sirens / sounders, break-glass units, fire retardant (PH120) cable, door magnets, door sequential closers, etc. Communication links and cabling to be provided from the fire detection control panel to the BMS system and Maestro system. Programming of the BMS system to the Maestro system shall be undertaken by the ELIDZ. In the event of a fire the early warning detection and alarm installation shall send a signal to the following electrical and mechanical systems: ❑ Air-conditioning and ventilation systems to close / switch off ❑ East London Industrial Development Zone Maestro System, which shall alert the relevant authority persons ❑ Fire doors to close and alarms / evacuation alarms to sound All exposed early warning detection and alarm-related conduit / cable tray / trunking shall be galvanized, yellow powder-coated, including relevant bushes, locknuts, couplings, galvanized saddles, etc. Conduit and Conduit Accessories / Cable Support Systems / Wire Duct and Mesh Installations shall comply with the requirements as detailed in the Electrical Engineering Specification.		
11.7.3 Fire Protection The site and facility / building are to be designed and constructed in accordance with the National Building Regulations SANS 10400 "Part T". The building is to be divided (fire divisions, etc.) in such a manner so as it does not need a sprinkler installation. Data Centre Halls and Meet-Me Rooms are to be 120 minute fire rated rooms, therefore any penetrations are to be fire proofed accordingly, by using correct passive fire protection methods (fire stops, fire dampers, etc.) in accordance with relevant SANS Standards (SANS 10400 / SANS10177). It is intended that the Data Centre facility shall be awarded the Tier III Classification. This classification means "concurrently maintainable", i.e. it must be possible that each and every capacity component and distribution path servicing the Data Centre facility must be able to be removed, on either a planned basis or for maintenance / replacement, without impacting the proper operation of the Data Centre facility.		
11.7.3.1 Fire Appliance Bulk Fire Water Supplies The Contractor shall provide a single, metered water connection to each building facility (site) separating into domestic water and manual firefighting systems (one water meter per site). The Contractors fire main reticulation shall be external to the building, including external fire hydrants and a fire booster connection at the site entrance, and shall enter and terminate within the facility floor with a minimum of a flanged 100mm diameter galvanized steel pipe. In the event of galvanized steel piping being used underground, all such underground steel piping and fittings shall be wrapped with "Wrap it Bond" in accordance with the manufacturer's specification / recommendations, and to the Client's approval, in order that the piping and fittings are fully protected against external corrosion. The Contractor shall be responsible for the entire fire appliance reticulation externally and within the respective buildings.		A C E L M S
11.7.3.2 Fire Appliance Installation *a) Fire Extinguishers* Fire extinguishers shall be supplied in accordance with SANS 10400 "Part T" of the National Building Regulations, with a Building Occupancy as detailed above in "Sub-heading 2", i.e.: ❑ 5 kg CO_2 type hand-held fire extinguishers complete with meranti wooden backing board, etc., where necessary ❑ 4.5 kg dry chemical powder type hand-held fire extinguishers, complete with meranti wooden backing board, etc., where necessary ❑ 9 kg dry chemical powder type hand-held fire extinguishers, complete with meranti wooden backing board, etc., where necessary		A C E L M S

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b) Fire Hose Reels Fire hose reels shall be supplied in accordance with SANS 10400 "Part T" of the National Building Regulations, i.e.: ❑ fire hose reels shall be provided within the buildings, at the rate of one (1) per 500 m^2 or part thereof, mounted at 1500 mm (to center of the appliance) above finished floor level, 30 m x 20 mm internal diameter rubber hose and nozzle, pressure gauge, brass water way and gland, stopcock, pipework etc. all in accordance with the relevant South African National Standards documentation. ❑ any piping feeding any single fire hose reel is to be a minimum of 25 mm diameter galvanized pipe in accordance with the relevant South African National Standards documentation. ❑ all pipework shall be hydraulically sized in accordance with the relevant South African National Standards documentation. *c) Fire Hydrants* Fire hydrants shall be supplied in accordance with SANS 10400 "Part T" of the National Building Regulations, i.e.: ❑ fire hydrants shall be provided within the buildings, at the rate of one (1) per 1000 m^2 or part thereof, together with the requisite number of hoses, couplings and 16 mm diameter nozzles. Pipework feeding fire hydrants shall not be less than 75 mm diameter. ❑ all pipework shall be hydraulically sized in accordance with the relevant South African National Standards documentation. *d) Fire Appliance Piping and Fittings* The fire appliance ring main within the facility / building shall be galvanized steel to relevant South African Standards, and shall include red bands every 6 m lengths. The dropper pipes to relevant fire hydrants / fire hose reels shall be cleaned, primed and painted with red oxide and signal red enamel paint on completion of installation. All piping shall be hydraulically pressure tested in sections, in accordance with the Contractor's construction Programme. The testing thereof shall be witnessed by the Contractor's responsible Personal, and the relevant pressure test certificates prepared accordingly. All pipe-work is to include galvanized / stainless steel hangers / fittings and must be adequately and neatly supported in both the horizontal and vertical direction. Welded sections of piping shall have flange / coupling joints at suitable intervals to facilitate removal. All fittings shall be groove type systems in accordance with SANS 1109 / BS21 and ASIB.		
11.7.4 Fire Suppression System		
11.7.4.1 General Description of Works The following rooms require a fire suppression system: ❑ Data Center Halls ❑ Meet-Me Rooms ❑ Utility Rooms (UPS Rooms, LV / MV Rooms) The fire suppression system shall comprise of a design and installation of an engineered fire detection and environmentally friendly (zero global warming potential) "total flooding", gaseous fire suppression system. The Contractor is to review all relevant drawings, so that all items affecting the operation of the fire detection / suppression system (such as equipment location, air diffusers, damper closures, floor voids, ceiling voids, hot aisles and door openings) are considered in the design of the engineered system. The gas suppression system used, shall be in accordance with International Standards and SANS Standards, and shall have full international approvals. Approval Certificates shall be submitted at time of tender by Contractor. The company performing the design work shall be accredited to the ISO 9001 Quality Management Standard. Proof of accreditation shall be submitted at time of tender. The fire suppression system design shall be performed by persons who are competent in the field of fire engineering. Individuals performing this work shall be registered with the Engineering Council of South Africa as Professional Engineers or Technologists in the field of Fire Engineering (i.e. Pr Eng or Pr Tech Eng), proof of qualifications shall be submitted at time of tender. The design and installation of the fire detection / suppression system will be in strict accordance with the standards and regulatory authorities as depicted above (Part 1). All engineering design and materials shall be provided for a complete fire detection / suppression system, including storage cylinders, nozzles, control panel, detectors, wiring, enunciators, alarm and all other equipment necessary for a complete operational system, to comply with a Tier III Classification.		A C E L M S
11.7.4.2 Submissions Working documents as defined in SANS/ISO 14520 part 1, Appendix A shall be submitted for approval within 4 weeks of contract award and prior to delivery of materials. This shall include, but not be limited to, the following: ❑ Aspirating Fire and Smoke Detector ❑ Extinguishing Control Panel ❑ Release devices ❑ Fire alarm devices ❑ Gas suppression storage cylinders ❑ Mounting brackets ❑ Discharge Nozzles ❑ Distribution Pipe work Isometrics ❑ Design / Computer Flow Calculations Information shall be provided, but not limited to : ❑ outlining the warranty of each component or device used in the system.		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
❑ outlining the operation and maintenance procedures that will be required of the Client. This information shall explain any special knowledge or tools the Client will be required to employ, and all spare parts that should be readily available ❑ Drawings indicating locations, installation details and operation details of all equipment associated with the fire suppression system ❑ Floor plans showing equipment locations, piping, point-to-point wiring and other details as required, including point-to-point electrical layout drawings ❑ Sequence of operation, electrical schematics and connection diagrams to completely describe the operation of the fire suppression system controls, etc.		
11.7.4.3 Equipment *a) Fire Control Panel* A 3 Zone Conventional Fire Control Panel shall be located adjacent to the main entrance / exit to the protected space. The panel shall be of rigid construction and shall be capable of being either surface mounted or semi recessed as indicated, where a semi-recessed collar shall be provided of identical color to provide a neat appearance. The panel facias shall be equipped with light emitting diodes to indicate fire, fault and operational status together with push action switches to control functions. The operation of the switches shall be accessed via a key switch or lockable front cover. The following components shall be provided on the control panel facia : ❑ Silence alarm switch ❑ Test evacuate alarm switch ❑ Alarm silenced lamp ❑ Isolate remote signal - switch and lamp ❑ System general fault - lamp and buzzer ❑ Buzzer silence ❑ Power on lamp ❑ Lamp test switch ❑ Extinguishant system automatic mode - lamp ❑ Extinguishant system manual mode - lamp ❑ Manual/Automatic mode - push switch ❑ Isolate extinguishant release circuit - switch and lamp ❑ Hold extinguishant released - switch and lamp ❑ Key operated security switch ❑ Manual release unit A sealed lead acid battery shall be provided within the control panel to provide a minimum of 24 hours of panel operation and a minimum of a ½ hour under alarm conditions. The control panel common fire and common fault volt-free contacts shall be monitored via the mine / plant SCADA/PLC or similar. The fire suppression control panel shall be linked and integrated to the building early warning detection and alarm installation, including the BMS System. *b) Aspirator Detection Device* The location of the aspirator detector shall be inside the protected area. The Aspirator detector shall be of rigid construction and provide a neat appearance. The Aspirator Detector shall have the following facilities, but not limited to : ❑ Inbuilt 7" colour touch screen multi-function, multilingual LCD. ❑ CFS Combined Fire and Smoke particle level status 'dial' ❑ CCD particle level status 'dial' ❑ SCD particle level status 'dial' per pipe ❑ 4 x programmable alarm points and output contacts for Pre-alarm, Fire 1, Fire 2 & Fire 3 per pipe ❑ LCD & LED status indication of Pre-alarm, Fire 1, Fire 2 and Fire 3 (per pipe if required) ❑ LCD & LED status indication of 'Common Fault' and 'Power Healthy' ❑ Detector 'Silence' and detector 'Reset' buttons ❑ Individual pipe 'High Airflow' and 'Low Airflow' fault monitoring status 'dials' ❑ CFS & alarm level sensitivity setting screen ❑ 5 x Programmable output contacts for Fault, Pre-Alarm, common Fire 1 signal, common Fire 2 signal, common Fire 3 signal, Pipe 1 Fire, Pipe 2 Fire, Pipe 3 Fire and Pipe 4 Fire ❑ 'HYBRID' double knock (dual technology particle increase) programmable output ❑ 'Optical' signal only programmable output ❑ 'HYBRID' output adjustable optical trigger points confirmed by Cloud Chamber per pipe. ❑ Common 'HYBRID' early warning adjustable optical trigger point confirmed by Cloud Chamber. ❑ 3 x Programmable input contacts for Isolate, Reset, Fault, Gain Set, Battery Fault band Mains Fault ❑ 7-day Day / Night mode programmable menu function ❑ Detector Text ❑ Pipe Text ❑ Alarm Text ❑ Programmable User and Engineer access codes ❑ IP Network configuration screen ❑ 10 minute 'Real-time' particle data graph ❑ 30 day 'Historic' particle data graph ❑ 24,000 event data logging facility		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
❑ Live camera stream from up to 6no. IP cameras ❑ 'Detector Tour' product training animation ❑ 'Engineers Fault Finding Assistant' training animations ❑ PNG format 'Pipe Plan' images to indication pipework configuration. ❑ Programmable On/Off detector audible buzzer ❑ Up to 4 x 'Individual Identifiable' sampling pipe 'Inlet' Ports ❑ Single sampling pipe 'Exhaust' port ❑ Support 25mm dia. sampling pipe configuration (subject to sampling pipe calculation program) ❑ In-built Protec 6000 Protocol loop interface ❑ In-built TCP/IP network interface ❑ RS485 Network configurable with other Aspirator Series aspirating detectors or Aspirator RDP (Repeat, Display, Programmer) ❑ Commissioning Engineer 'Log' and 'Notepad' Individual sampling pipe airflow monitoring must be provided at the aspirating fire detector to detect changes in the pipe work airflow. When correctly adjusted, a FAULT condition is enunciated when the flow in any pipe increases or decreases beyond design limits. The common fault volt-free contacts shall be monitored via the Fire Control Panel. All internal circuitry within the detector shall be powered by a suitable approved 24V DC power supply with stand-by batteries to provide a minimum of 24 hours of detector operation and a minimum of ½ hour under alarm conditions. *c) Remote Status / Gas Control Panels* The remote status panels shall display lamps indicating the system is in manual, automatic or discharged conditions. They shall also have an automatic / manual or manual only mode key-switch. In addition, a yellow manual release call-point shall be fitted. *d) Visual / Audible Alarms* All audible alarm devices shall have the function to switch between a primary fire alarm speech message with a warble preamble tone, to gas release imminent second tone with a preamble tone. The primary alarm speech message shall provide a general fire alarm message directing persons to the nearest available exit, whilst the second alarm message shall inform persons of an imminent suppression discharge. Upon discharge, the speech tone shall switch back to the primary alarm speech message. All visual alarm devices shall be a flashing beacon. This can be separate or integral with the audible alarm device. Mounting heights for the visual / audible alarm devices shall be agreed on site. *e) Remote Lamp Unit* Remote lamp units shall be provided to give indication of an activated smoke detector within a ceiling or floor void. *f) Relay / Interface Units* In the event of a fire, relays / interface units shall be installed to: ❑ Shut the air-conditioning and ventilations systems off ❑ Interface to the building early warning detection and alarm installation and BMS System ❑ PDU Shut Down Relay shall be provided to shut down the PDU on receipt of a second stage fire signal *g) Manual Call Points* Manual call points shall be connected to Zone 3 of the Fire Control Panel to signal a General Fire Alarm. Fire alarm manual call point unit's casings shall be colored red and shall be inscribed with the lettering "FIRE" with a re-settable element. All manual call points must be fitted with a plastic cover to deter hoax alarm signals. Each unit shall have a test key. *h) Electrical Reticulation* All wiring associated with the system will have a red cable sheath and shall be a minimum of a PH30 (fire resistant not fire retardant) or equivalent for circuits requiring prolonged operation during a fire, complying to SANS10139. All fire suppression-related conduit / cable tray / trunking shall be galvanized, yellow powder-coated, including relevant bushes, locknuts, couplings, galvanized saddles, etc. Conduit and Conduit Accessories / Cable Support Systems / Wire Duct and Mesh Installations shall comply with the requirements as detailed in the Electrical Engineering Specification. *i) Fire Suppression Pipework* All pipe work and fittings downstream of the pressure reducing orifice shall be painted heavy grade steel pipe. Pipes shall be seamless and be certified to ASTM A106 Gr B. Fittings shall comply with the requirements of BS 3799 and be of the 3000-pound type. Test certificates for all piping and fittings shall be provided by the Contractor. All pipework and fittings fabricated shall be de-greased with a suitable de-greasing agent. After de-greasing the pipework and fittings, they shall immediately be painted with red oxide (PA10) self-etching primer. All void pipe-work to be painted with red oxide and exposed pipe-work to be painted with red oxide and also signal red enamel. All pipe-work is to include galvanized / stainless steel hangers / fittings and must be adequately and neatly supported in both the horizontal and vertical direction. Where sleeves are required through wall, floor, etc. penetrations, they shall be built into the structure by the Contractor in such a manner as to maintain the integrity of the structure and the fire barriers. *j) Warning Signs*		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
Fire Suppression entrance warning signs shall be provided and displayed at each entrance to the protected area. Fire Suppression manual release warning signs shall be provided and displayed next to each extinguishant release unit. *k) Fire Suppression Cylinders* A multiple of fire suppression cylinders shall be installed to provide the overall required storage capacity. The system shall be operated by a pilot cylinder incorporating both manual and electrical solenoid operation. Operation of the system using detonators shall not be permitted. Cylinders shall be manufactured from steel with a seamless construction in accordance with EEC/84/585. Each cylinder shall have been pressure tested to a test pressure as required by the Contractor's Supplier details. Each cylinder shall be fitted with a pneumatically actuated quick action discharge valve and a removable dial faced pressure gauge. Cylinders shall be floor mounted and securely fastened back into a purpose made racking and braced installation. Each cylinder shall be provided with a certificate provided by the company who charge the vessel with the gas mixture. Each of the cylinders shall be interconnected with a passivated steel manifold. The manifold shall be tested at works to a pressure of at least 300 bar. Each branch connection from the manifold to a vessel shall be fitted with a steel non-return valve assembly.		
11.7.4.4 Fire Suppression System Description and Operation The gas protection system shall be a fire suppression system total flooding, gaseous, clean agent, fire extinguishing system designed to provide a uniform concentration of extinguishing medium within the protected area. The amount of fire suppression to be provided shall be the amount required to obtain a uniform (minimum) concentration as required by the design manual. Take into consideration such factors as ceiling / floor voids, un-closable openings (if any), "rundown" time of fans, time required for dampers to close (and requirements for any additional dampers), and any other feature of the facility that could affect concentration. Pre-Alarm: When any aspirator pipe reports a pre-alarm, this shall provide a visual alert and an audible buzzer on the aspirator, and a volt free contact shall operate providing a general pre-alarm signal. Fire Alarm: When any aspirator pipe reports a fire, this shall provide a visual alert and an audible buzzer on the aspirator, and a volt free contact shall operate providing a fire alarm signal to a conventional fire alarm zone circuit. Note that 2 floor void pipes on each aspirator shall be crossed zoned and 2 room / ceiling void pipes on each aspirator shall be cross zoned ensuring redundancy, in the event of a failure on any aspirator unit. When a conventional zone circuit is in fire mode, the Fire Control Panel shall operate the general fire alarm circuits and operate the fire alarms. Coincidence Detection: The fire suppression system shall be automatically operated when at least two conventional zones report a fire with an agreed time delay. The Fire Control Panel shall initiate the gas tone sounders. The Aspirating Fire Detection System must contain two separate detection elements to detect two different phenomena associated with fire (fire particles and smoke particles). The aspirator detector shall include, as its primary sensor, a 'Cloud Chamber' fire detector. This is supplemented by high sensitivity 'Optical' detectors provided within each of the four detector sampling ports. The aspirator shall be designed and installed to the applicable South African National Standards and the FIA (UK) Code of Practice for Design, Installation, Commissioning & Maintenance of ASD Systems for the detection of fire within the room including all floor voids and any ceiling voids deemed to pose a fire risk. The aspirator air sampling pipe and fittings shall be ABS pipe that is designed to be used in fire detection applications. All sampling holes (nozzles) are to be clearly identified by means of a colour coded Hole Identification Tag. The aspirator Pre-Alarm threshold shall be set to an increased sensitivity to allow the possibility of a local investigation of equipment / materials that are over-heating. The Fire 1 threshold for room and void sampling shall be set to a less sensitive setting as determined by performance testing as per the FIA (UK) Code of Practice.		A C E L M S
11.7.4.5 Fire Suppression System Sequence of Operation The principal of the fire suppression system sequence is to be followed, but may not be limited to the below operation, i.e. different sounding alarms / bells for different fire stages can also be implemented, etc. Activation of the Pre-Alarm Level warning on the aspirator shall: ❑ signal the local Fire Control Panel and to a dedicated 24/7 Security Control Room via a building addressable early warning detection and alarm installation ❑ latch and energize the Pre-Alarm Level lamp. A Pre-Alarm message shall be displayed on the aspirator touchscreen display Activation of the Red Fire Alarm Manual Call Point shall: ❑ cause a first stage fire alarm on the local Fire Control Panel ❑ The Fire Control Panel shall transmit a fire alarm signal to the remote monitoring system / BMS or addressable early warning detection and alarm installation ❑ operate auxiliary contacts for air-conditioning / fan shutdowns and automatic dampers via the local Fire Control Panel Activation of any single room or floor void aspirator pipe detector, in any detection zone, shall: ❑ cause a first stage audible general fire alarm and visual alarm ❑ operate auxiliary contacts for air-conditioning / fan shutdowns and automatic dampers via the local Fire Control Panel ❑ transmit an alarm signal to remote monitoring via the local Fire Control Panel ❑ energize a lamp on the activated detector and local Fire Control panel (and graphic enunciator, if included) Activation of a second room or floor void aspirator pipe detector, on another detection zone, shall: ❑ cause a second stage gas tone alarm to operate ❑ initiate a programmable time delay and an alarm bell (Fire Suppression agent release) Activation of an extinguishing system manual release call point shall: ❑ override any a first stage audible general fire alarm from detector inputs ❑ cause a second stage aspirator gas tone to operate		A C E L M S

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❑ initiate a programmable time delay and an alarm bell (Fire Suppression agent release) Upon completion of the time delay, the aspirator system shall: ❑ energize the control solenoid for fire suppression cylinder's releasing gaseous agent into the protected area ❑ indicate gas released on the gas control unit and fire alarm panel ❑ Switch the second stage fire suppression speech alarm / alarm bell to a general fire alarm speech message		
11.7.4.6 Room Integrity Testing The Contractor shall perform a room integrity test using door-fan testing equipment as required in SANS/ISO 14520 Appendix E. The test shall be performed by a certified individual and company and a test certificate shall be issued stating the minimum hold time for the room.		A C E L M S
11.7.4.7 Commissioning and Testing The Contractor shall inspect all components of the fire suppression systems at work, and ensure the system is designed, supplied and installed to the relevant standards. The Contractor shall allow within his works for a demonstration of the correct operation of all components of the system. On completion of the commissioning the Contractor shall issue a certificate of compliance and a certificate stating that the system is operating correctly and in a 'live' condition. Full operating and maintenance instructions shall be provided by the Contractor. These shall be included in the OEM manual, along with As built drawings, computer calculations and room integrity test report.		A C E L M S
11.7.5 Builder's and Related Works The Contractor shall be responsible for the necessary co-ordination and timing of the builder's and related Works pertaining to this Contract. All Utility Rooms shall be constructed with the necessary floor trenches for the installation of all associated mechanical services.		A C E L M S
11.7.6 Trench Excavations The Contractor shall undertake all trench excavations, including backfilling and compaction, required for the mechanical installation. Where possible, all routes should be either parallel or perpendicular to the nearest building and / or structure, maintaining a minimum distance of 0.5 mm from the edge of the foundation of the boundary wall and or building walls. The Client / Employer should be notified immediately should any deviations to the routes be required. The bottom of the trench shall be level and clean, and the bottom and sides free from rocks or stones liable to cause damage to the piping, equipment, etc. The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage. Any subsidence, either during the construction period, or the guarantee period, shall be remedied. The backfilling of all post-mounted, or similar, luminaires shall be done with a 10 : 1 sand / cement mix.		A C E L M S
11.7.7 Ducts The Contractor shall be responsible for the provision of all ducts necessary for the mechanical associated installations. In summary, ducts shall be installed beneath (across) all walkways, driveways, and finished surfaces. Ducts between the chiller condenser units and the Data Center building floor void may be required, including removable galvanized steel lids for access. The ducts are to be sized that there is enough space around the chiller water pipes for access and maintenance requirements. All ducts intended for future use shall be sealed.		A C E L M S
11.7.8 Access Floor The Contractor shall be responsible for the provision of all raised access floors within the respective Data Centre Halls, Meet Me Rooms, etc. The access floor shall be utilized for the purposes of reticulating and distribution the various electrical, mechanical and telecommunications systems into the respective Data Centre Halls, Meet Me Rooms, etc.		A C E L M S
11.7.9 Water Services		
11.7.9.1 Domestic Cold Water The Contractor shall provide a single, metered water connection to each building facility (site) separating into domestic water and manual firefighting systems (one water meter per site). The external domestic water reticulation shall enter and terminate within the respective buildings with a flanged copper steel pipe. The pipework entry point to the respective building is to be limited to one, or as agreed with the ELIDZ. All services, including drainage / water supplies, are to be reticulated into the service ducts, or are to be exposed (where permitted) for maintenance purposes. The factory floor shall be provided with an internal cold water ring, with connection points for the Tenant's production-related domestic water requirements. Where applicable, an allowance is to be made for the domestic water connection to the Tenant's chiller plant systems. The cold-water reticulation within the buildings shall comprise "half hard", class 2 copper pipework and fittings, in accordance with the relevant South African National Standards documentation.		A C E L M S

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11.7.9.2 Domestic Hot Water Hot water generation to the office block shall be in the form of a suitably-sized, highly efficient, high temperature (55 °C) solar water geyser system (in accordance with relevant SANS requirements), sized in accordance with the hot water requirements of the office block. The solar panels or tubes shall be placed on the roof of the office block, correctly positioned for maximum sun exposure. The hot water generation system shall include the necessary pressure and temperature gauges on incoming (return) and outgoing (feed) hot water lines, hot water circulating pumps, pipework, fittings, valves and insulation providing an energy efficient system. Where the roof space is shaded and solar water generation is not feasible, heat pump systems can be considered as agreed and approved with the ELIDZ. The hot-water reticulation within the buildings shall be "half hard", class 2 copper pipework and fittings, in accordance with the relevant South African National Standards documentation. Where long hot water pipe runs are required, the piping shall be reticulated in a ring form in order to eliminate dead legs and water wastage. The insulation of all the hot water piping shall have a thermal resistance (R-Value) of 1, using k-value data of 40˚C or higher.		A C E L M S
11.8 Staff Training		
The Contractor shall provide comprehensive training of male and female operational staff and nominated maintenance personnel, to the approval of the Client / Employer. Training shall be comprehensive, covering all aspects of systems installed as part of these Works. The Contractor shall provide a detailed training programme and a copy of the training documentation to the Client / Employer, for comment and review, no less than 4 weeks prior to the commencement of training. No training will commence on site prior to the written approval of the Client / Employer. Should the Client / Employer not approve the training programme and documentation, the training programme and documentation will be referred back to the Contractor for re-evaluation and re-submission to the Client / Employer. The number of staff to be trained is to the full discretion of the Client / Employer. However, the Contractor shall allow for 4 groups, each of up to 4 personnel. Each group shall receive a minimum of two 2-hour training sessions. One of these sessions shall be held prior to the commissioning of the electrical engineering services installation, and the other of these sessions, upon expiry of the defects liability period. Training shall be adequate to ensure that the groups trained are : ❑ competent in the operation of systems ❑ adequately trained to carry out on-going training ❑ fully aware of the location of all equipment installed as part of this Contract within their area of responsibility The names of personnel attending the training shall be recorded and submitted to the Client / Employer at the conclusion of training. Maintenance staff shall demonstrate a complete understanding of the location and connectivity of the various elements of the electrical engineering services installation. All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on site by the Client / Employer.		A C E L M S
12 PROJECT CLOSE OUT		
12.1 ELIDZ Asset/Equipment Information Requirements		
The format of the information is to be adequately structured and developed for inclusion in asset register: Water Meters: a) Location; b) Type, make, size, serial number Sump and Pump Details: a) Location; b) Type and make; c) Pumping capacity; d) Motor type and make; e) Motor rating; f) Control method; g) Control equipment details; h) Monitoring equipment: type, make, capacity etc; i) Supplier; j) Guarantee expiry dates (Pumps, Motors, Control equipment, Monitoring equipment) Electrical Equipment Details: a) Location; b) Transformer capacity; c) Maximum demand design provision; d) Size of incoming mains; e) Make, type and rating of main LV protection on owner's mainboard; f) Trip settings on lv protection; g) Size and ratings of mains supplying sub distribution boards; h) Serial number of transformer; i) Transformer ratings; j) HT switch ratings; k) Type of power skirting; l) Make of light fittings; m) Standby electrical supply system (type and make, capacity/rating, kVA rating, alternator (type and make), fuel tank capacity, fuel consumption at full load, serial number, supplier)		A C E L M S

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	n) UPS system (make, capacity/rating, serial number) o) Electrical meter (make, capacity/rating, serial number, CT ratio and calibration certificate where relevant) p) Guarantee expiry dates (Distribution boards, Main boards, HT equipment, Standby generator, UPS system)		
Air Conditioning Systems	a) Contractor b) Location c) Designed load d) Installed load e) Type of A/C system f) Make of A/C system g) Make of chillers h) Type of chillers i) Tonnage of chillers j) Chiller refrigerant k) Maximum operating pressure l) Condenser type m) Type and rating of driving unit n) Details of after Coonan o) Details of air handling units, fan sizes, capacity and make, p) Chilled water pump details q) Condenser water pump details r) Details of cooling tower, design capability, make and motor ratings s) Water treatment details t) Heating provision u) Schematic control layouts v) Air conditioning electrical load w) Guarantee expiry dates (Air-conditioners, Chillers, Condensers, Fans, Motors)		
Sprinkler Details	a) Provide a complete set of as built floor plans, control schematic showing piping layouts, sizes, isolation points and Sprinkler positions		
Fire Protection 1: Booster Pump Details	a) Location b) Make c) Supplier d) Driver motor capacity e) Non-return valves		
Fire Protection 1: Standby Booster Pump Details	a) Location b) Make c) Supplier d) Driver motor capacity e) Operation details		
Fire Protection 1: Fire Hose Reels	a) Provide a complete set of floor plans showing the position of all fire hose reels		
Fire Protection 1: Guarantee Expiry Dates	a) Sprinkler installation b) Booster pump c) Standby booster pump d) Hose reels e) Date of ASIB inspection and clearance (ASIB clearance certificate to be attached where applicable)		
Fire protection 2: Fire Extinguishers	a) Contractor b) Location: provide a complete set of floor plans, indicating the position and type of all extinguishers installed c) Guarantee expiry date		
Fire protection 3: Fire Detection	a) Contract b) Type of detection system c) System design: provide a complete set of drawings indicating the position of all detection units and sensors as well as full schematics layouts d) Guarantee expiry date e) Earthing report enclosed?		
Dock Levellers	a) Location b) Make, capacity, guarantee expiry date		
Lifts and Escalators	a) Contractor b) Make of equipment c) Number of units d) Serial numbers e) Lift loading per (Lift, Stretcher lifts, Escalators, Hoists, Other) f) Electrical drawings: provide a complete set of as built drawings and control schematics of all electrical details g) Certification certificate		

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	h) Features (Standard car finishes, Non-standard car finishes, Power failure homing)		
Kitchen Equipment	a) Contractor b) Make and description of equipment c) Guarantees		
Access Control Systems	a) Provide a complete set of as built drawings and schematics showing all access control points b) Location c) Make, type, controller unit, battery backup rating d) Lock type (e.g. mag lock, strike lock etc) e) Guarantee expiry date		
CCTV systems	a) Location b) Make, type and description of equipment c) Guarantee expiry date		
Irrigation System	a) Sprinkler heads (type, make, capacity/size) b) Controller units (location, type, make) c) Pump (location, type, make, capacity, rating) d) Set of as built drawings and schematic showing all irrigation points, meters, valves, piping, pumps, controller units and cabling routes		
12.2 ELIDZ Operating and Maintenance Manuals Requirements			
General	a) Colour coded Bantex 40mm plastic Lever Arch (code1451) files are to be used, dividers are not required, however an A4 Index page is to be fixed to the inside face of the file which clearly depicts the project name and description, Consultant and/or responsible person name and contact details, and file content. b) Files should contain suitably folded hard copies of "As Built" drawings as well as electronic copies on clearly labelled CD-R disks.		A C E L M S
Architectural Input (Black Colour-Coded File)	a) Introduction and Location of works. b) Project Description: Detailed description of intent and built structure, JBCC PBA, project value, date of Practical Completion and latent defects period. c) Project directory: Names and contact details of all consultants, project manager, contractor, sub- contractors and suppliers. d) Health and Safety: Significant residual hazards and safety requirements. e) Drawing schedules: Listed and incorporated in file. f) Component schedules: doors, windows etc. g) Specifications, guarantees, warranties and maintenance contracts, BCM approvals. h) Priced Bill of Quantities. i) Certificate of Occupancy.		
Civil Engineer (Black Colour-Coded File)	a) Project Description: Detailed description of intent and built structure, JBCC PBA, project value, date of Practical Completion and latent defects period. b) Health and Safety: Significant residual hazards and safety requirements. c) Drawing schedules: Listed and incorporated in file. d) Component schedules: doors, windows etc. e) Specifications, guarantees, warranties and maintenance contracts, BCM approvals.		
Structural Engineer(Black Colour-Coded File)	a) Project Description: Detailed description of intent and built structure, JBCC PBA, project value, date of Practical Completion and latent defects period. b) Health and Safety: Significant residual hazards and safety requirements. c) Drawing schedules: Listed and incorporated in file. d) Component schedules: doors, windows etc. e) Specifications, guarantees, warranties and maintenance contracts, BCM approvals. f) Engineers certificate.		
Electrical Engineer (Blue Colour-Coded File)	a) Project Description: Design intent and description of installation. b) Health and Safety: Simplistic guide to working with the installation safely. c) Drawing schedules: Listed and incorporated in file. d) Certificate of Compliance. e) Authorities certificates for all installations. f) Component schedules. g) Specifications and guarantees for each item of equipment where applicable. h) are Maintenance requirements and agreements, maintenance manuals etc. i) Emergency contact details.		
Mechanical Engineer (Green Colour-Coded File)	a) Project Description: Design intent and description of installation. b) Health and Safety: Simplistic guide to working with the installation safely. c) Drawing schedules: Listed and incorporated in file. d) Authorities certificates for all installations. e) Component schedules. f) Specifications and guarantees for each item of equipment where applicable. g) Maintenance requirements and agreements, maintenance manuals etc. h) Emergency contact details.		
Fire detection and prevention consultant (Red Colour-Coded File)	a) Project Description: Design intent and description of installation. b) Health and Safety: Simplistic guide to working with the installation safely. c) Drawing schedules: Listed and incorporated in file.		

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
d) Authorities certificates for all installations. e) Component schedules. f) Specifications and guarantees for each item of equipment where applicable. g) Maintenance requirements and agreements, maintenance manuals etc. h) Emergency contact details.		
12.3 ELIDZ CAD and GIS Specification / Requirements		
12.3.1 CAD Record drawings a. CAD Record Drawings are to be provided in the following format: i. REVIT is to be used for all record drawings and disciplines. Al coordinated services drawings are to be produced in this format and the file is to form part of the close out pack. The file ownership will have to be transferred to the ELIDZ. ii. Electronic format – dwg, dxf and pdf (each pdf drawing size to suit the scale shown on the drawing) formats. If the native file format of the CAD package utilized is not dxf or dwg, then the native file format is also to be included Note that the ELIDZ has been experiencing trouble in reading some dxf files provided from some CAD programs, and it would be appreciated if consultants could run all dxf drawings through AutoCAD to check that they actually contain legible information - when viewed in AutoCAD - prior to forwarding. Note also, that scanned PDF drawings, containing marked-up images but not containing vector information (as sometimes provided by contractors) are not an acceptable electronic format. b. Consultants using CAD programs which utilise plot style tables (or equivalent) are to provide all their plot style tables utilised on the project. c. Drawings require to contain information in separate layers, as per ELIDZ's GIS requirements and specification. Each layer is to be discreetly and individually accessible, and is to have a logical name, which easily defines its content. d. Attached is a listing of layers within the GIS system. Record drawing layers are to parallel these layers where relevant. e. Where possible, all rooms within buildings should have a unique number assigned to them (such numbers to be placed in a separate layer on the CAD drawing). All equipment subsequently provided in each room is to be linked to these unique room numbers.		A C E L M S
12.3.2 GIS Drawing Requirements Typically, engineers and other building professionals prepare as built/record drawings using CAD technology, primarily for presentation purposes. As long as the drawing looks correct when presented in this 2D format, little regard is often paid to how the drawing is structured. Because of this lack of structure within the CAD file as well as a lack of line congruency between features (such as valves along a pipe, or cables on either side of a Street light), the task of transforming this CAD data into GIS is a time-consuming exercise. In order to introduce standards and consistency into how the ELIDZ is provided with GIS data, this specification details the basic requirements of how such data is to be supplied to the ELIDZ. The requirements of this specification must not be confused with, or replaced by, the requirements relating to the provision of CAD record drawingzs as described above. a) **Layout drawings only** - For the purposes of GIS drawings, only layouts/plans require to be provided. Details, elevations, sections etc are not required to be provided for GIS purposes. b) The CAD file must be simplified into its simplest components i.e. no complex entities, library elements etc eg "explode objects" (AllyCAD), "drop complex" (MicroStation) and "explode" (AutoCAD) c) **Line intersections:** all line data must be properly intersected, with no dangles or overhangs or duplicate lines. All lines must intersect with zero tolerance. This includes line intersections through valves or other objects. Lines should meet perfectly at the centre of the object, ignoring the edge of the object circle or symbol. d) **Text placement:** text pertaining to data, for example the diameter or material type of a pipe, should be placed over the item to which it refers - rather than some distance away with an arrow pointing to the pipe. e) **One drawing per service -** For AutoCAD (or other CAD software) users that use "viewports" in the digital document, please save a separate .dwg file for each layout, as other software packages are not capable of reading more than one layout per digital document. f) **One layer –** only one service per layer. For example: all wastewater pipes should be placed in a layer called "wastewater pipes"; all electricity cables should be placed in a layer called "electricity cables", etc. g) **Absolutely clean layers -** there cannot be roads/north arrows/trees/contours/cables etc in a "sewer pipes" layer. The GIS operator will have to assume whatever is in the "sewer pipes" layer is indeed sewer pipes. In order to achieve such clean layers, it is recommended that the following procedure is adopted: • Isolate each layer by turning all other layers off and see that there are no stray drawing elements or features that belong on other layers. • Erase those elements that do not belong on the layer, or cut and paste them into their proper layer. • Repeat for all the layers in the drawing. (Note: layer 0 and "defpoints" are inherent in all CAD drawings. These layers cannot be deleted but should contain no objects.) h) **Georeferenced -** the CAD file is to be correctly referenced in real-world coordinates. To check that real-world coordinates have been used, when moving the mouse cursor cross the CAD file, coordinates should read something like: XY = 79,000, -3,660,000 The coordinate system to be used is a Transverse Mercator projection with central meridian of 27 and based on WGS84 datum. In other words, the ideal solution would be that CAD drawings should be geo-referenced. i) **Coordinate marks -** If the above is not possible then at least four coordinate marks (crosses with labels) must be provided on the drawing. j) When handing over CAD drawings/data the consultant should provide the following information (**metadata**): • Title/Drawing number		A C E L M S

ELIDZ Design Specifications	Contractor's Proposal	Notes A=Architect,C=Civil,E=Electrical,L=Land ,M=Mechanical,S=Structural
• Digital filename of CAD drawing (if different from hardcopy title/drawing number) Version/status/revision of CAD drawing (final version? Surveyed or planned?) A clear indication if • it is an "as built" drawing. • Construction date of data displayed on CAD drawing (when were the services on the drawing finally constructed) This is NOT the drawing date. • Name of CAD operator/responsible/contact person if any further queries need to be made. k) Data is to be supplied on compact disc (CD) or DVD. Each disc must be clearly labelled as to the project represented by the data, together with the relevant consultant's name.		