



- (h) Fresh Air Supply Fans with different sizes in diameter for the centrifugal in-line tube Fan litres per second at different static pressure C/W 2 x 600 Sound Attenuators with pods and electrical box and a timer controlled.
- (i) Duct plenum box (600 X 300) c/w with washable filters cartridge of 595 x 295 x 50mm with a filters size with a lockable door site door c/w including all fitting, rods, hangers and brackets.
- (j) Category-1: Rectangular insulated galvanized low pressure ducting including (below steel trusses or concrete soffits including support mechanisms including Stop ends, Radius bends, Square bends, 45° bends, 15° bends, 90° bends, transformations, trouser & shoes pieces. With butterfly damper c/w lockable quadrant at the ducting outlets supply points.
- (k) Outdoor Weather louvre and door grills with different size C/W vermin proof screen, storm resistant and natural anodised aluminium with low regenerated noise.
- (l) Disc Valves with different sizes in diameter with a colour hospital white power coated.
- (m) Galvanised finished light duty cable tray complete including all the accessories.

#### 16. VRV (VARIABLE REFRIGERANT VOLUME) SYSTEM WITH HEAT RECOVERY

This is an air conditioning system which allows a large number of indoor units of different capacity and type to be connected to a single refrigerant piping system and a single central outdoor unit.

This system realizes an individual air conditioning system that can respond to the increasing personal air conditioning needs and can respond to the future expansion and needs of a building. The system can easily be extended by the addition of further indoor units at a later date. The VRV has many advantages, among others being energy - efficiency, space saving and noise control, efficient execution of operation control according to air conditioning load.

The heat recovery mode must be incorporated to the system and it enables a cooling/heating system that automatically selects either cooling or heating according to heat load that differs for each room throughout the year, and furthermore makes effective use of waste heat when cooling or heating. In fact, heat recovery enables simultaneous automatic cooling and heating operation with one system.

Heat Recovery is achieved by the addition of a gas suction pipe to the existing liquid and gas discharge piping of the refrigerant system. The simultaneous availability of both cooling and heating functions is then achieved through the selection of either the gas discharge or the gas suction pipe in accordance with the ambient temperature and temperature settings.

At this point the control circuit is used for the capacity control of the indoor unit heat exchanger and the outdoor unit compressor and heat exchanger in order to achieve perfect performance through the collection and delivery of the precise amount of refrigerant required. Moreover, the perfect control of the thermal balance is achieved by the use of an inverter and fan speed adjustment control which in turn permits stable and efficient control in response to the independent selection of cooling or heating mode for each indoor unit.



## 17. CASSETTE SPLIT TYPE AIR CONDITIONERS

The 118 slim air conditioners of the heat recovery type shall be supplied and installed in the positions as indicated on drawing. Each unit shall have a cooling capacity as indicated on the below mentioned table below and illustrated on the drawings, for room conditions of  $22^{\circ}\text{C} \pm 1,5^{\circ}\text{C}$  dry bulb and 50% relative humidity with an outside air temperature of  $42^{\circ}\text{C}$ .

Each unit shall consist of a direct expansion fan coil unit installed in the ceiling and connected to the central outdoor unit (air cooled condensing unit) mounted on a concrete plinth as shown on the drawings and as per clause 3.2.0.

Each fan coil unit shall be complete with suitable filters, multi-speed recirculation fan, adjustable directional air discharge grille and direct expansion cooling coil fitted into an appropriate cabinet.

Each unit shall be provided with interconnecting refrigerant circuits (insulated) and electrical wiring between components.

The unit shall be standard factory manufactured, completely weather-proofed for outdoor installation, internally insulated, properly assembled, thoroughly tested and operation charged with a more ozone friendly refrigerant such as e.g. 407, however units operating on R22 as refrigerant will still be acceptable.

Units with insufficient capacities shall not be accepted.

The units shall be standard factory manufactured. The maximum noise level within the room shall not exceed NC 35. Equipment noise levels shall be specified in detail in the Schedule of Particulars.

Each indoor unit must be provided with a drip tray to facilitate condensate removal. An  $\varnothing 28\text{mm}$  Copper condensate drain pipe with a booster pump shall be provided and shall lead to the nearest suitable drain point.

A control panel shall be provided in the position as indicated on drawings 1,4m above floor level. The control panel shall include the switch-on-off of the fresh air supply fan.

The fresh air fan and the air conditioner must be inter-connected.

A room type temperature sensor shall control the room temperature.

(See clauses 4. 1.1 and 4.1.5).

The units shall have the specified capacities at the following conditions:

▪ Outdoor Temperature	:	42 °C db ; 22.0 °C wb
▪ Room Temperature	:	22 °C db $\pm 1,5^{\circ}\text{C}$ ; 50 %/ RH
▪ Altitude above sea level	:	1200m



- 17.1 A: Slim Normal heat recovery cassette units with total number and capacities of the units are as following:

Description	Number of units	Capacity (Kw)
4Way Cassette units wind-free (VRV)	15	7.1
4Way Cassette units wind-free (VRV)	1	9.0

- 17.1 B: Slim 360° heat recovery cassette units with total number and capacities of the units are as following:

Description	Number of units	Capacity (Kw)
360° Cassette units wind-free (VRV)	4	7.1

- 17.1 C: Wall mounted split type of air conditioning units with total number and capacities of the units are as following:

Description	Number of units	Capacity (Kw)
Independent Midwall unit (Server Room)	2	2.8

- 17.1 D: Slim Heat Recovery 600 x 600mm cassette units with total number and capacities of the units are as following:

Description	Number of units	Capacity (Kw)
4Way Cassette units wind-free (VRV)	48	2.8
4Way Cassette units wind-free (VRV)	12	3.6
4Way Cassette units wind-free (VRV)	4	4.5
4Way Cassette units wind-free (VRV)	45	5.6
4Way Cassette units wind-free (VRV)	15	7.1

## 17.2 Filters

Disposable dry medium filters shall be mounted in a slide in frame at the inlet of the air conditioning unit. Face velocity across the filters shall not exceed 1, 5 m/s.

Filters shall be at least 50mm thick and have an efficiency of at least 95% at a particulars size of 5 micrometres.

### 17.3 Indoor Controller Unit

Room temperature shall be controlled by means of a room air thermostat for both cooling and heating cycle. The thermostat shall be of the single stage cooling, single stage heating type to facilitate automatic changeover between heating and cooling operation. Capacity control of the unit shall be by loading or unloading of cylinders and/or switching compressors on or off as necessary. Compressor starting / stopping shall be in sequence to equalize compressor running hours.

An On/Off control panel shall be provided and installed for the rooftop unit in the position shown on the drawing.

Condenser temperature control shall be by means of the on / off switching of condenser fan. The compressors shall be interlocked with both the supply and condenser fans to prevent compressors switching ON without airflow over the evaporator and condenser. (See Clause 4.39.0)

## 18. FRESH AIR SUPPLY FAN SYSTEMS (SAF)

Fresh Air Supply Fans with different sizes in rectangular ducted ventilation system for the in-line ducted fans with model No (ILB/6-285) low pressure ducted fans per cubic meter per hour different static pressure C/W 300 x 600 Sound Attenuators with pods and electrical box with a multi-function controller and an external interface module (MIM-B14). The contractor must include the electrical wiring cost for the interlocked between the outdoor condensing units and the fresh air supply fans units or equivalent.

### 18.1 Features;

- a) The fan casings shall be manufactured from a heavy gauge galvanised sheet steel. All fan will have an inspection cover that can be removed to access the motor/impellers assembly.
- b) The motor/Impellers shall be direct-drive low pressure curve centrifugal impellers and complete assembly be dynamically balanced to ISO 21940-11:2016 standard.

### 18.2 Motor

All the motors will incorporate asynchronous induction motors with squirrel cage rotor in die cast aluminium and are manufactured in accordance with IEC 34-1 and 14 Standards

#### Specifications;

- Single phase 230V 50Hz
- IP55 protection
- Class F insulation
- Thermal Overload protection
- Sealed for life, ball bearing assemblies
- Interlinked with the outdoor VRV condensing units.



### 18.3 Attenuators

The acoustic attenuators will be supplied with sound absorbing.

The In-Line duct fans shall have the following minimum capacities each against the resistance of its own system:

Description	SAF-01	SAF-02	SAF-03	SAF-04	SAF-05	SAF-06	SAF-07
Volume Flow m <sup>3</sup> /s	1.200	1.364	0.8000	0.3052	0.1952	1.431	1.364
Static Pressure (Pa)	411.6	489.9	646.9	365.6	224.0	481.9	489.9
Diameter (mm)	600 x 300	600 x 300	600 x 300	600 x 300	600 x 300	600 x 300	600 x 300
Air Velocity m <sup>3</sup> /h	2.39	5.54	6.37	3.99	6.34	5.81	5.54
Speed rpm	1130	1350	825	46.0	42.0	1350	1350
Motor: Peak Power (Kw)	0.410	1.28	0.879	0.221	0.119	1.28	1.28
Motor Power	4.40	1.50	1.21	0.260	0.140	1.50	1.50
Current (Amps)	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Sound Pressure Level (db)	66	66	65	57	45	66	66
Power Supply	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase

The fan speeds shall not exceed 1450r/min and shall be of the two-speed type. Each system shall be equipped with two sound attenuators, one before and one after the fan as shown on the drawings.

The sizes of ducting shall be as shown on the drawings. The sizes of air grilles and diffusers shall be as shown on the drawings. Each system shall be equipped with disposable dry media filters at least 50 mm thick and with an efficiency of 95% at a particle size of 5 micrometres.

The face velocity on the filters shall not exceed 1.5 m/equipment noise levels shall not exceed NC 35.

The control for the fans in the system shall be incorporated in the control of the split type air conditioners and also be interlinked therewith.  
(See clause 4.2.0 and 3.15.10.)

### 19. DRAIN PIPING

Interconnecting copper drain piping  $\varnothing 28\text{mm}$  shall be taken from each unit's drain pan. The piping shall be taken along route leading terminating in a waste water pipe in the service duct behind the Men's and Ladies rooms. The copper piping and fittings shall be class 1 to SABS 460:1985, as amended.

Drain piping shall be tested for leakages by closing the outer end of the drain pipe and then filling water in the entire piping length; before the pipes are buried/encased/concealed. Water shall be retained in the piping till actual



commissioning is to be done. On completion of leak test both ends of the pipes shall be capped to prevent dust, debris, etc. from entering and choking the pipes during construction. The piping shall be insulated according to clause 4.38.4.10.

20. **DUCTING**

The sizes and layout of the flexible and rigid ductwork shall be as shown on the drawings. Where sizes are not indicated it shall be sized to suite the fan.

The rigid ductwork for the fan coil units and the ductwork for the fresh air supply fans systems shall be externally insulated according to clause 4.38.2.4. The dimensions of ductwork shown on the drawings are the free airflow area and allowance must be made for the thickness of the insulation.  
(See clause 4.36.0 and 4.38.2)

21. **AIR GRILLES DIFFUSERS AND LOUVRES**

The sizes of air grilles, diffusers and louvers shall be as shown on the drawings. Outdoor weather louvre C/W vermin proof screen and storm resistant. The double sided door grills with natural anodised aluminium (500 x 200mm doors) C/W vermin proof screen with low differential pressure and low regenerated noise.(See clause 4.37.0)

22. **FRESH AIR DAMPERS**

The sizes of fresh air dampers shall be as shown on the drawings. The dampers shall comply with the clauses 4.37.5.1 - 4.37.5.5.

23. **FIRE DAMPERS**

The sizes of fire dampers shall be as shown on the drawings. The Fire dampers operate by fusible links, shall be provided in each air ducting outlets connections and form of integrate of the construction of the fan units.

The fire dampers shall be designed to close automatically and remain tightly closed upon the operation of an approved fusible link heat actuated devices. It will be located where readily affected by abnormal temperature in the duct. The devices shall have a temperature rating approximately 20 degrees above the maximum temperature that would normally be encounter when the system is in operation or shut down and be self-supported in case the duct destruction due to heat. The dampers shall comply with the clauses 4.35.1 – 4.35.12.

24. **ELECTRIC EQUIPMENT AND WIRING**

Tenders must allow for the complete electrical installation and wiring in accordance with the Standard Specification for Electrical Installations and Electrical Equipment Pertaining to Mechanical Services, Issue IXa, and December 1999.

The following power points will be provided by others and all wiring from these points will be included in the tender price:-

- (a) A 20 Amp, 220V, single phase 50Hz power point with isolator near each cassette unit in the ceiling void.
- (b) A 60V,100V & 120V 3 phase 380-415V, 4 wire, 50Hz power point with weather proof isolator at each VRV air conditioning condensing units positioned in the plant-room as shown on the drawings.



- (c) A 30Amp, 220-240V, 50Hz single phase wall mounted isolator for each fresh air supply fans.
- (d) A 30amp, 1 phase, 50Hz power point with next to in-line duct fresh air supply fan with the electrical box (150 x 200mm) with the with a multi-function controller and an external interface module (MIM-B14). The contractor must include the cost for the installation of the timer and the electrical wiring in the ceiling void.

(See clause 3.16.0)

## 26. **AUTOMATIC CONTROL SYSTEMS**

### **Room Control**

- This is a simplified operation where the range of control has been limited to START/STOP. Detects room temperature & fan speed.
- The wiring system is a cross-over based on two wire signal lines.
- Room temperature sensors are normally built in.
- The remote control is a standardised are for all indoor units.
- The system panel has got temperature selection and it is used in conjunction with a centralised controller.

### **System Controller**

- This can operate several units of air conditioners. The system has on ON/OFF function and an LCD is displayed for each group. There is also a mode changeover operation temperature setting.
- The system is setup such that individual controls can operate.  
The system is shown on drawings.

### **Note:**

The switching and setting of the fan speed shall be accomplished from a remote fan switch, which is to be installed, 1400mm from floor level as been indicated on the drawings

The wiring between the remote controller and the unit shall not be surface mounted and is therefore to done in conduit chased into the wall also with a connecting box.

The control will be mounted on a meranti hard wooden back plate next to the electrical light switch but 200mm away from the light switch.

Department will on acceptance of such a tender inform the prospective contractor in writing as to the make, and/or type of equipment accepted. HOWEVER, it should be noted that the use of words "OR EQUAL" by the tender is to be discouraged and could lead to the disqualification of the tender.



# **KIMBERLEY: DPWI KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM**

## **SPECIFICATION FOR THE MECHANICAL INSTALLATION COMPREHENSIVE CONTRACT**

### **PART 4**

### **TENDER ADDINATION SPECIFICATIONS**





## **ADDITIONAL SPECIFICATION**

### **SA 1A GENERAL MAINTENANCE**

#### **CONTENTS**

SA 1A 01	SCOPE
SA 1A 02	MAINTENANCE REQUIREMENTS
SA 1A 03	MAINTENANCE CONTROL

#### **SA1A 01 SCOPE**

The Contractor shall be responsible for the compilation of complete sets three of Operating and Maintenance Manuals. A separate Operating and Maintenance Manual shall be supplied for each installation as defined in sections 4.1.5 to 4.1.5.4

#### **SA1A 02 PROCEDURE FOR SUBMISSION OF MANUALS**

##### **SA1A 02.01 SUBMISSION OF DRAFT MANUALS**

A draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer prior to safety inspection of the installation. Approval of the draft Operating and Maintenance Manuals shall be a prerequisite for commencement of the safety inspection in terms of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

The manuals will be reviewed and checked by the Engineer and returned to the Contractor with comments, where necessary. The Contractor shall make the necessary changes and amendments to the manuals to incorporate the Engineer's comments.

##### **SA1A 02.02 DEVELOPMENT OF FINAL MANUALS**

A final draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer at least one week prior to commencement of Day 1 tests on commissioning. This set of manuals will not be accepted without the Contractor's verification of the information contained in the manuals and the professional language editing thereof.

The Engineer shall return the manuals to the Contractor, who shall make the final corrections. The Engineer will, however, not be responsible for the quality control on manuals. Approval of final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Practical Completion for repair of the installation.

After the Engineer has approved the final Operating and Maintenance Manuals, the Contractor shall provide the Engineer with seven (3) sets of the manuals. Approval of the final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Completion.



**SA1A 03     FORMAT OF OPERATING AND MAINTENANCE MANUALS**

(a). Manuals shall be bound in hardcover ***lever-arch files*** with plastic coatings. The files shall be clearly labelled on the front cover, as well as on the back band, with the following information:

1. The title "Operating and Maintenance Manuals"
2. Name of the installation (as defined in Additional Specification SA: General Maintenance)
3. Name of the contract and contract number
4. The Contractor's name, address and contact telephone number and fax (logo optional)
5. Month and year in which the manuals are finally handed over to the Employer
6. Name of the User Client.

(b). upon project completion, submit operation and maintenance manuals, consisting of the following:

1. Index sheet, listing contents in alphabetical order
2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams shall be placed in plastic pockets of the file.
3. Drawings and diagrams larger than A3 shall be folded and placed in plastic pockets to be easily removed or stored.
4. The sections of the manuals specified below shall be clearly partitioned.
5. Cross-referencing between drawings/diagrams and text shall be in a clear and consequent format. As-Built interconnection wiring diagrams
6. The Operating and Maintenance Manuals shall be supplied in English.
7. Recommended spare parts list.
8. Copy of the warranty.
9. An electronic copy of the final manual shall be handed to the engineer upon approval of the operation and maintenance manuals



## **ADDITIONAL SPECIFICATION**

### **SA1B      GENERAL TRAINING OF AIR CONDITIONING AND VENTILATION**

#### **CONTENTS**

SA 1B 01	SCOPE
SA 1B 02	BASIC METHOD REQUIREMENT
SA 1B 03	TRAINING OF MAINTENANCE PERSONNEL

#### **SA1B 01      SCOPE**

The Contractor shall be responsible for providing diverse training Management, including operating and maintenance personnel. The Contractor shall develop and facilitate initial training sessions for all parties. An accredited trainer shall present all training sessions.

This specification includes all requirements for methods to be employed, the syllabus required by the User Client, the syllabus required for maintenance managers and workers and the specification of measurement and payment.

#### **SA1B 02      BASIC METHOD REQUIREMENT**

The Contractor shall be responsible for conducting a complete investigation of the group that have to be trained in order to compile a proper training plan.

The investigation shall cover at least the following aspects:

1. Assess likelihood of conformance to task-specific requirements (*status quo*) of capabilities.
2. Identify minimum pre-qualification criteria in terms of existing knowledge and skill level in relation to reaching target requirement
3. Evaluate personnel in terms of pre-qualification criteria and tasks to be performed (skills profile).
4. Identify training needs.
5. Develop appropriate and accredited training courses and material in terms of task-specific and identified training needs, and compile the training syllabus per installation.

#### **SA1B 03      OPERATIONAL TRAINING OF USER CLIENT PERSONNEL**

The Contractor's training shall include training of the User Client's operators on biannual basis to acquaint them with operating of installations (especially electrical and mechanical systems).

The training sessions shall comprise on-site (hands-on) demonstrations, and shall be conducted over two-day periods.

The content of training courses for operators shall include the essential features of operating the installation, as also described in the Operating and Maintenance Manuals.

Completion of an installation shall, in terms of the Special Conditions of Contract, be subject to successful completion of training.



The training shall also be based on the Operating and Maintenance Manuals.

No training shall commence without the Engineer's approval of the final draft Operating and Maintenance Manual for the particular installation

#### **SA1B 04      GUIDELINE FOR THE USE OF THE MAINTENACE SCORE – CARD**

The score-card and performance indicators must be used as a maintenance management tool. The aim with score-card is to ensure that:

- (a) The project focuses on the key aspects of maintenance per month.
- (b) The contractor receives payments for his work, and
- (c) The employer receives value for money and a sustained high level of services.

Performance indicators must be selected to measure the contractor's service level of preventative and corrective maintenance that will be based on the Maintenance Control Plan and Operation and Maintenance Manuals (containing information specified in the Contract documentation).

For each specific installation, different performance indicators must be defined each month based on the content of the Maintenance in relation to the scope of maintenance work per installation and must be based on the Contractors service level records on preventative and corrective maintenance.

Breakdowns must be dealt with if and when necessary by logging of the breakdown and monitoring the downtime.

The contractor and the Engineer must agree on all performance indicators at an occasion prior to the month during Contractors performance (services level of maintenance) will be measured.



**DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE  
MAINTENANCE SCORE-CARD**



**CONTRACT NUMBER: WCS** \_\_\_\_\_

**CONTRACT:** \_\_\_\_\_

**CONTRACTOR:** \_\_\_\_\_

**ENGINEER:** \_\_\_\_\_

**INSTALLATION:** \_\_\_\_\_

**MONTH:** \_\_\_\_\_

**OF 24**

The following components of the installation were selected by the contractor at the Monthly Maintenance Meeting

No

--	--

as performance indicators to be tested according to specification:

**1. CONTRACTOR'S SELECTION**

1.1 \_\_\_\_\_

1.2 \_\_\_\_\_

1.3 \_\_\_\_\_

1.4 \_\_\_\_\_

1.5 \_\_\_\_\_

**SUBTOTAL:**

0	1

The following components of the installation were selected by the Engineer as performance indicators to be tested

*According to specification:*

**2. ENGINEER'S SELECTION**

2.1 \_\_\_\_\_

2.2 \_\_\_\_\_

2.3 \_\_\_\_\_

2.4 \_\_\_\_\_

2.5 \_\_\_\_\_

**SUBTOTAL:**

0	1

**TOTAL SCORE:**

--	--

\_\_\_\_\_  
**Engineer's Representative**

\_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Date**

		/			/		
--	--	---	--	--	---	--	--



# **KIMBERLEY: DPWI KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM**

## **SPECIFICATION FOR THE MECHANICAL INSTALLATION**

### **COMPREHENSIVE CONTRACT**

## **PART 5**

### **GENERAL SPECIFICATION FOR THE SUSPENDED CEILLINGS**

## **KIMBERLEY: DPWI KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM**

### **1.0 INTRODUCTION**

The South African Building Interior Systems Association (SABISA), currently under the aegis of AAAMSA, promotes that part of the building industry which specializes in the interior finishing, altering and/or refurbishing of buildings. Membership constitutes manufacturers and suppliers of ceiling, partition and access flooring systems as well as subcontractors who sell and install these specialized systems.

This specification refers to the design, finishes, materials and installation of ceiling systems and will enable Architects, Engineers, Quantity Surveyors, Developers and other specifies to select and specify the appropriate materials.

Having the installation done by subcontractors who are members of our Association will ensure that the installation meets with the minimum performance standards



**KIMBERLEY: DPWI KIMBERLEY REGIONAL OFFICES REPLACEMENT OF  
AIRCONDITIONING SYSTEM**

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## **KIMBERLEY: DPW KIMBERLEY REGIONAL OFFICE REPLACEMENT OF AIRCONDITIONING SYSTEM**

### **1 INTRODUCTION**

The Association of South African Quantity Surveyors offers, inter alia, the following specification guidelines in their Standard System of Measuring Building Work 1999: Sixth Edition (Revised).

#### **1.1 BILL OF QUANTITIES**

Description in bills of quantities shall be complete and clear.

Unless otherwise stated the description of each item shall be deemed to include manufacturing, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting, waste, patterns, templates, plant, temporary works, return of packing's, establishment charges, profit and other obligations arising out of the conditions of contract.

Unless prescribed, the method of execution of the work shall be at the discretion of the contractor.

#### **1.2 CEILINGS**

Ceilings shall be given in square meters, under headings separating nailed up and suspended ceilings, distinction being made between horizontal, sloping and vertical ceilings.

Bulkheads, fire barriers and the like shall be given in meters. Alternatively, when linear measurement is not practicable, bulkheads, fire barriers and the like may be given in detail in appropriate terms.

No deductions shall be made for openings, vents, etc., not exceeding  $0.5\text{m}^2$ .

Plastering shall be included in the descriptions, no distinction being made for narrow widths.

Branding shall be included in the descriptions of nailed up ceilings. When Branding is not to a regular pattern, it shall be given separately in meters.

Proprietary support systems for suspended ceilings shall be included in the descriptions of the ceilings. When the support system is not to a regular pattern it shall be given separately, in which case branding or bearers shall be given in meters and hangers in number. A general description of the supporting structure from which ceilings are suspended shall be given. Separate items shall be given for ceilings suspended less than 1m (one meter) below suspension level, and thereafter in successive stages of 1m (one meter).

Circular cutting shall be given in meters. Notches and holes shall be deemed to be included in the descriptions. Openings for light fittings, mechanical diffusers etc., shall be given in number, as extra over ceilings and descriptions shall be deemed to include additional trimmers, hangers etc. Cover strips, jointing strips etc., shall be included in the descriptions.

Cornices shall be given in metres and descriptions shall be deemed to include metres and intersections.

Trapdoors shall be given in number, as extra over ceilings and descriptions shall be deemed to include trimmers. Insulation materials such as fiberglass and mineral wool shall be given in square metres, stating whether in batts or rolls such as between roof timbers etc.

### 1.3 SABISA GUIDELINES FOR SUSPENDED CEILINGS INSTALLATION

Recognizing that problems and misunderstandings can occur between the contracting parties, the following provisions are recommended to prevent such problems arising.

#### 1.3.1 CO-ORDINATION WITH MECHANICAL, ELECTRICAL AND OTHER TRADES

All work of other trades above the ceiling shall be completed prior to the start of the ceilings. Where ductwork is so extensive as to make it impossible to install hangers in an area, the mechanical trades shall provide proper framing of adequate strength to support the ceiling from their framing, or extra payment for bridging shall be allowed to the ceiling contractor

It shall be the responsibility of all trades that incorporate any surface recessed, or units suspended, into the ceiling, to do these without distortion or damage to the ceiling.

Mechanical, electrical and other trades shall make available to the ceiling contractor, prior to the start of the ceiling installation, adequate descriptive literature, samples and shop drawings of any item that is to be carried by or fixed to the ceiling.

All windows and exterior doors shall be in place and glazed and the roof shall be watertight prior to the start of the ceiling installation.

It is essential that the work of ALL wet trades shall be completed and adequately dried prior to the installation of ceiling products. This includes, inter alia, grinding of terrazzo floors, floor screed, brickwork and plastering.

Installation of the ceiling materials should be made only when the temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied. It should be noted that not all materials are equally sensitive to humidity and temperature. Reference should be made to the manufacturer of the specific product involved.

## 2. MATERIALS

**Materials shall comply with the latest editions of the following specifications and requirements.**

Material	Specification
Plasterboard	SANS 266
Plasterboard cove cornice	SANS 622
Softwood rendering and battens	SANS 653
Fibre-cement boards	SANS 803
Softwood studs for timber frames in buildings	SANS 1146
Materials for thermal insulation of buildings - Part I and II	SANS 1381
Materials for thermal insulation of buildings - Part IV	SANS 1381
Materials for thermal insulation of buildings - Part VI	SANS 1508
Expanded polystyrene thermal insulation boards	EN13964:2004
Mineral fibre board	

### 3.7 Suspension Drops (measured from purlins)

Not exceeding 1m Sq.m  
Exceeding 1m but not exceeding 2m Sq.m  
Exceeding 2m in 1m increments to a maximum of 3.6m Sq.m  
Exceeding 3.6m introduce sub-grid Sq.m

### 3.8 Work in confined spaces

Not exceeding 5m<sup>2</sup>Sq.m  
Exceeding 5m<sup>2</sup> but not exceeding 12m<sup>2</sup> Sq.m  
Exceeding 12m<sup>2</sup> Sq.m

The Engineers shall agree to fix points before any fixings are made. Hangers shall be suspended only from the main structure.

Descriptions of ceilings shall be deemed to include: hangers, suspension systems, ceiling panels and plaster finish where specified, as well as positioning of diffusers and light fittings, as required for setting out ceilings to layouts approved by the Architect and for modifications to standard suspension systems as necessary to work around any air-conditioning ducts or pipes or light fittings. (Sub-grid is optional).

## 2.3 COMPLIANCE WITH STANDARDS

“The Application of the National Building Regulations” SANS 10400 Part T: 2006 3rd. Ed – Fire Protection states in paragraph 4.13 Ceilings. Quote:

**4.13.1** In any building that is not a building classified as H3 and H4, combustible material shall not be used for any ceiling or suspended ceiling, or as a component thereof, except as provided for in (a) and (b) below

- a) An insulation, roof lining or ceiling tested in accordance with SANS 10177-5 and found to be combustible or used as part of a roof assembly, shall be acceptable if it complies with the requirements of SANS 428 when tested in accordance with SANS 10177-10. Provided that this requirement shall not apply where the thickness of such combustible material is less than 0,5mm and such finish adheres fully to a non-combustible substrate.
- b) Air supply grilles or return air intake grilles of combustible material, where the sum of the area of all such grilles form not more than 5 % of the total area of such ceiling and the overall area of any individual grille is not more than 0,09 m<sup>2</sup>, shall be permitted.

**4.13.2** Where roof space is formed between a ceiling and a roof covering, such space shall be divided into areas of not more than 500 m<sup>2</sup> by means of non-combustible fire-stops with a stability and integrity rating of at least 20 min. The distance between such fire-stops shall be not more than 30m, provided that this requirement shall not apply where such roof space and the room below are protected by a fixed automatic fire-fighting system and an automatic smoke control system (or both).

Any such roof space used as an air-conditioning or artificial ventilation system plenum shall comply with the requirements contained in 4.43.6. Any under-roof insulation or insulation used in the roof space shall be considered as a ceiling and shall comply with all the relevant requirements.

## 3. RECOMMENDED SPECIFICATION AND BILL OF QUANTITIES FORMAT



- 3.1 Installation of the suspended ceiling shall be in accordance with the SABISA's General Specification for Suspended Ceilings, including flush plastered ceilings in horizontal applications.
- 3.2 Description of the material specification, trade names where applicable and sub-grid.
- 3.3 Description of phased installation (e.g. gridding before boarding)
- 3.4 **Description of Board type and finish**  
e.g. 9.5mm Plasterboard:  
600mm x 1200mm exposed grid mineral fibre  
600mm x 300mm concealed grid mineral fibre etc. Sq.m
- 3.5 **Description of the supporting structure**  
e.g. 25 Mpa concrete slabs  
125 x 50 x 2.5mm steel purlins at 2000mm centers  
114 x 38mm timber joints at 900mm centers etc.  
*If steel purlins, state what sections i.e. cold rolled lip or hot rolled angles.*
- 3.5.1 **Fixings**  
Test results to be obtained from suppliers/manufacturers.  
Aluminium pop rivets are not recommended for suspension systems.
- 3.6 **Finished floor to ceilings heights**  
Not exceeding 2.5m Sq.m  
Exceeding 2.5m but not exceeding 3.5m Sq.m  
Exceeding 3.5m but not exceeding 5.0m Sq.  
Exceeding 5.0m
- 3.7 Suspension Drops (measured from purlins)**  
Not exceeding 1m Sq.m  
Exceeding 1m but not exceeding 2m Sq.m  
Exceeding 2m in 1m increments to a maximum of 3.6m Sq.m  
Exceeding 3.6m, introduce sub-grid Sq.m
- 3.8 Work in confined spaces**  
Not exceeding 5m<sup>2</sup> Sq.m  
Exceeding 5m<sup>2</sup> but not exceeding 12m<sup>2</sup> Sq.m  
Exceeding 12m<sup>2</sup> Sq.m
- 3.9 Perimeter Trims**  
Horizontal  
Raking  
Vertical  
Short, i.e. less than 60mm  
To columns, with full description of column girth and shape circular  
Extra over for labour, for notching around architrave returns, into reveals, chamfering, packing out etc.
- 3.10 Light fittings, air-conditioning etc.**  
Support for these services is to be fully described with the openings measured in number; the sizes to be specific; stating whether the service is to be flush or recess mounted; and stating whether trims are required.
- 3.11 Temporary access for services

Provisional sum for materials  
Provisional sum for labour.

#### 4. RECOMMENDED PREAMBLES

4.1 The installation of the suspended ceiling shall be strictly in accordance with the latest specification and co-ordinated ceiling layout drawings. To ensure a quality installation with satisfactory performance life, it is strongly recommended that members of the South African Building Interior Systems Association (SABISA) are employed. Certificates of compliance as issued by the contractor may provide further proof of competency. SABISA monitors its members for the use of correct installation techniques, the use of quality materials, and the application of quality workmanship.

4.2 Mechanical, electrical, air-conditioning, plumbing and other services (e.g. sprinklers) shall be installed prior to the start of any ceiling installation and the respective trades shall make available to the ceiling contractor, prior to the start of the ceiling installation, adequate descriptive literature, samples and shop drawings of any item that is to be carried by or fixed to the ceiling. (Refer also Section 1.3).

4.3 The following to be enforced:

4.3.1 All wet trades shall be completed and adequately dry prior to the installation of ceiling products. This includes grinding of terrazzo floors, floor screed, brickwork and plastering of walls.

4.3.2 All work of other trades above the ceiling shall be completed prior to the start of the ceiling installation.

Note! Where ductwork is so extensive as to make it impossible to install hangers in an area, the mechanical trades shall provide proper framing of adequate strength to support the ceiling from their framing. Under no circumstances is the ceiling grid to be suspended from any of the service installations.

4.3.3 All windows and exterior doors shall be in place and fully glazed and the roof and/or intermediate floor slabs shall be watertight prior to the start of the ceiling installation.

4.4 Mineral fibre and other similar ceiling panels are to be installed only in areas where temperatures and humidity conditions approximate the interior conditions anticipated during occupation.

Note! Air-conditioning should be fully operational prior the installation of ceiling tiles. A minimum RH of 60% should be maintained before installing ceiling panels.

#### 5. SUSPENDED CEILING TILES

Ceiling tiles are manufactured from a wide variety of materials, including composite materials. Typically, suspended ceilings tiles will be manufactured from:

Substrate	Approximate Mass (kg/m <sup>2</sup> )	Thickness
-----------	---------------------------------------	-----------



Cellular (EPS, PIU etc.)	Subject to enquiry	Subject to enquiry
Fibre-cement	5.54 or 8.32	4 or 6mm
Fibre-cement Vinyl covered	5.74 or 8.52	4 or 6mm
Fibre-cement with polystyrene	5.82 or 8.60	27 or 29mm
backing Plasterboards Vinyl covered	6.6 or 10.0	9.0mm or 12.5mm
Plasterboards Vinyl covered	8.78 or 10.0	12.0mm or 12.5mm
Mineral Fibre Vinyl Glass Wool	4.5	15.0mm
Pressed Metal/Pan Metal	1.1	25.0mm and 40.0mm

### Tile sizes

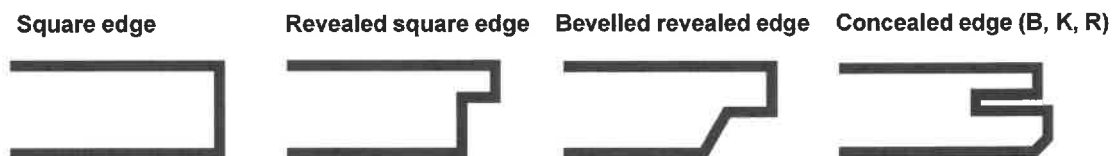
Tiles vary in size but sizes are determined by the tolerance of the ceiling grid.  
Typical sizes are:

Nominal size	Actual size
1200 x 600mm -	1195 x 595mm
600 x 600mm -	595 x 595mm
1500 x 500mm -	1495 x 495mm
500 x 500mm -	495 x 495mm

Other sizes require discussion with the ceiling tile and grid manufacturers. Imperial sizes are no longer used as a standard in South Africa nor in most other African countries.

*The manufacturer's recommendations regarding the installation and maintenance of mineral fibre and other similar ceiling panels must be adhered to at all times. Alternative edge details and grid systems may be available; contact the manufacturer for further information.*

### TILE EDGE DETAIL (TYPICAL)



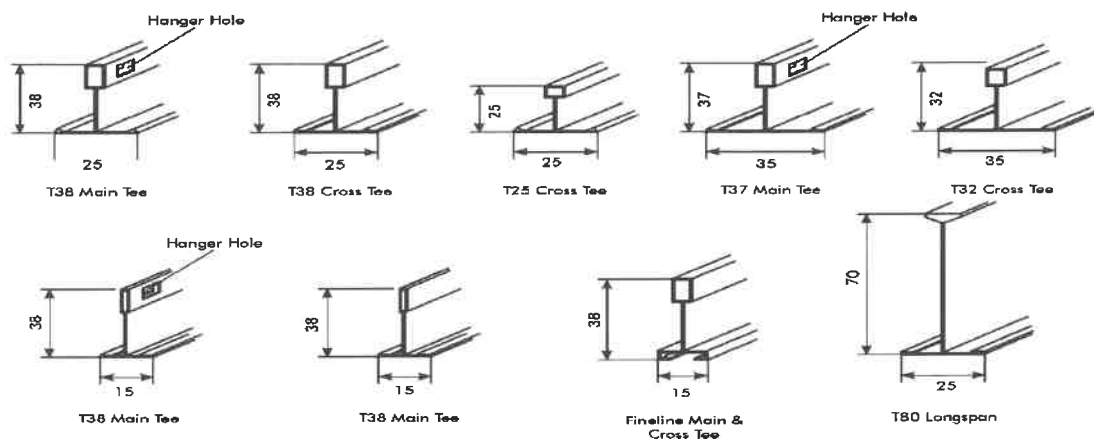
## 6. SUSPENDED CEILING GRID

Ceiling Grid Systems are manufactured from cold rolled, formed, galvanized mild steel and are faced with capping which is usually coloured. Capping may be manufactured of aluminium or steel.

The standard face widths of the grid system are 15mm, 25mm and 35mm. Each width has its own preferred application, but no real construction criteria exist for their respective usage. i.e. a 15mm grid system will accept any lay in tile size; a 25mm and a 35mm grid will do the same. However, some revealed edged tiles will only fit into the narrow grid (15mm). We therefore recommend that, when specifying revealed edged tiles, the correct grid for the particular tile should be checked.

Here are some suggested drawings below as shown here:

### STANDARD FACE DIMENSIONS (mm)



The wide grid (35mm) is recommended in areas where additional support for the ceiling tile is required, e.g. under outside overhangs where the nature of the tile makes accurate sizing of the tile difficult to control.

Manufacturers may be contacted for a detailed installation process of suspended ceiling grid systems. Manufacturers' test certificates may be requested for performance of grids. Grids must conform to BS 8290.

#### Maximum spans of suspension on main tee

Standard tees shall be supported at a maximum of 1.2m centers. For greater spans, contact the manufacturer for details.

#### Junction between Perimeter Trims and Ceiling Grid

For cross tees greater than 600mm, an additional suspension point should be added. Cross Tee's exceeding 400mm must be suspended  $\pm 100$ mm from the perimeter edge. When using a lightweight tile e.g. Mineral fibre, the above is not required.

#### Sloped, Angled, Specialized and Other Ceiling levels

These ceilings require specialist fixings. Contact the manufacturers for detailed information.

#### Perimeter hangers

The first suspension support on the main tee shall be not more than 400mm from wall.

### 7. PERIMETER TRIMS

#### Perimeter trims – Standard suspended ceilings

Perimeter trims for suspended ceilings may be L-shaped or shadow-line type (stepped) – refer Typical Cornice Trims.

#### Perimeter trims – Flush plaster suspended ceilings

Galvanized angles are L-shaped, or a shadow-line type may be used to create a shadow-line which hides building imperfections – refer Typical Galvanized Angles.

The perimeter trims are measured as a separate item in bills of quantities.

#### Flush plaster suspended ceilings



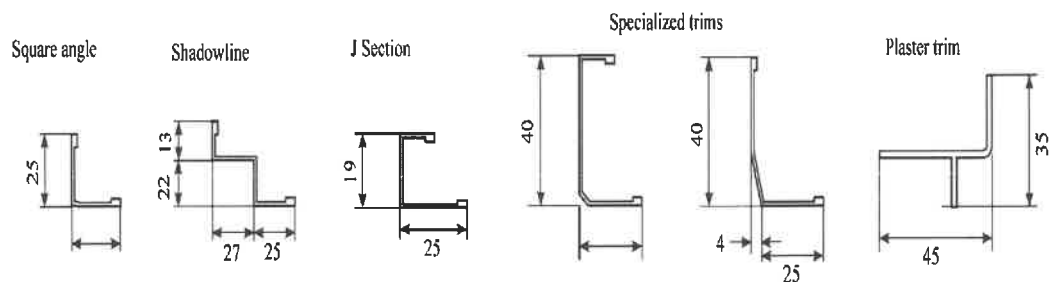
To minimise the effects / risk of cracking on plastered ceilings, it is advisable to allow the grid to “float” i.e. don’t fix the components to the perimeter.

Where cross Tee’s exceed 400mm from the perimeter wall, an additional suspension hanger (galvanized angle) must be fitted; this will prevent the board lifting when being plastered.

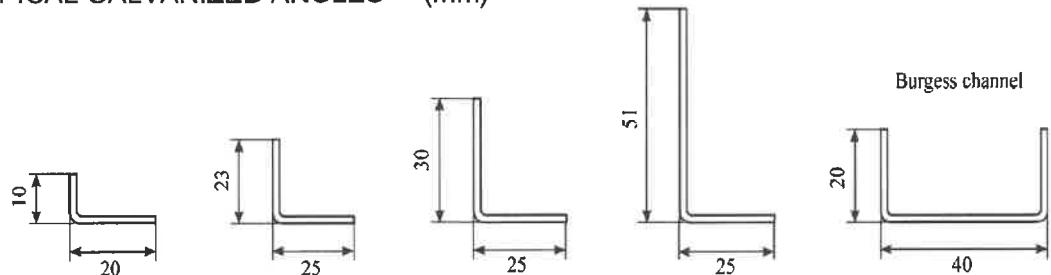
#### Exposed suspended ceilings

Main tees are fixed to the wall with angle cleats which are attached to the tee web and are secured through the wall angle or perimeter trim to the wall. This is to stabilize and align the ceiling as well as to avoid displacement of the tees during erection. Tee’s are fixed after the first row of cross tee’s have been clipped into the main tee, this enables erection from a fixed reference point.

#### TYPICAL CORNICE TRIMS (mm)



#### TYPICAL GALVANIZED ANGLES (mm)



### 8. SUB-GRID SYSTEMS

Sub-grid construction is required when:

Hanger is out of plumb by more than 25mm for 150mm depth and ceiling is suspended by more than 3.0m.

The ceiling plumb suspension height exceeds 3.0m.

### 9. SUSPENSION COMPONENTS

Suspension components will consist of a number of different items which when combined/joined or used in conjunction with each other will create an effective suspension system. The weakest component/joint in the system will determine the breaking point of the suspension system. This information is available from the various manufacturers.



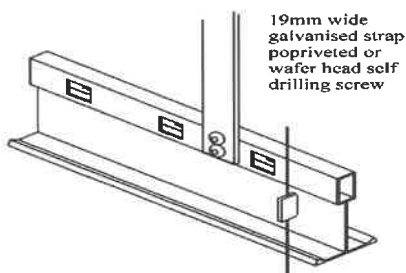


Often a substitute product will be used to suspend a ceiling grid system. The onus is on the specifier to ensure that components that comply with minimum standards are used. Guidance can be obtained from the grid manufacturers

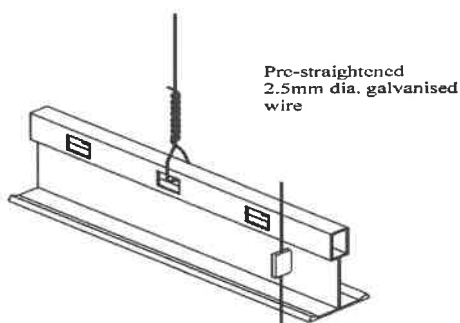
**Typical standard/approved components are:**

- Pre-straightened galvanized hanger wire 2.5mm or thicker
- Galvanized 19mm wide x 0.8mm thick steel hanger strap 4mm suspension rods with adjustable spring clips.
- Galvanized angle 20mm x 20mm x 0.6/0.8mm (Minimum)
- Galvanized angle 25mm x 25mm x 0.6/0.8mm (Minimum)
- Galvanized angle 50mm x 25mm x 0.6/0.8mm (Minimum)

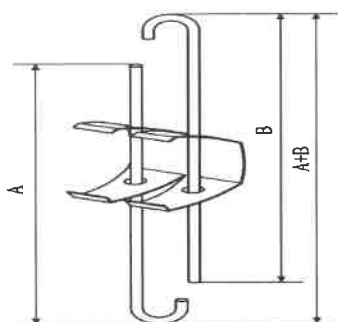
**TYPICAL SUSPENSION COMPONENTS**



**19mm Strap Suspension**



**2.5mm Wire Suspension**



**Angle Suspension**

Fixings/Fasteners used are:

- Pop rivets 3.2mm steel x 2
- Wafer Head tek screws 4.5mm x 13
- Shots & pins
- Nylon plug & nails
- Nail plug & anchors
- Angle cleats 20mm x 30mm
- Hold down clips / wires

Consult manufacturer of fixings and fasteners for the correct selection.

To ensure a higher safety factor for suspended ceilings it is recommended that the number of fixings is doubled. The manufacturer of the fixing component is responsible for the carrying, shearing and/or any other loads that their fixing can sustain.

Ceiling grid manufacturers will offer construction guidelines but the ultimate responsibility rests with the specifier to ensure that the correct fixing method is used for each particular situation. It is also important to note that the building structure must be of such a nature that it is able to sustain the load of the ceiling that has been specified, with the permissible (§) wire suspension and suspension intervals and/or deviations from the vertical position.

- Hanger spacing to be a maximum of 1.2m on the main tee
- Hanger should not be out of plumb by more than 25mm for 150mm depth.

## 10. CEILINGS AND FIRE

### Combustibility

Materials used for the construction of ceilings are to be classified in accordance with SANS 428:2006 Ed 1 entitled "Fire performance classification of thermal insulated building envelope systems" in November 2006.

The symbolic classification will inform the professional and /or consumer about the limitations and usage of a product. This information will appear on the product, technical data sheet as well as the packaging.

#### B.1 Combustibility and surface fire properties

The symbols given in tables B. and B.2 shall be used to indicate combustibility and surface fire properties.

**Table B.1 – Symbolic classification of non-combustible materials**

1	2	3	4
Surface fire properties			
Small-scale application a	Large-scale application b	Behaviours of material	Classification
Flame height from fire source mm			
2 000	4 000	No flame spread	A1
3 000	6 000	Low flame spread (no flaming droplets or burning brand)	A2
		Low flame spread (with flaming droplets or burning brand)	A3
4 000	8 000	Average flame spread (no flaming droplets or burning brand)	A4
		Average flame spread (with flaming droplets or burning brand)	A5
4 000	8 000	Rapid fire spread	A6
a When determined in accordance with SANS 10177-10. b When determined in accordance with SANS 10177-11.			

**Table B.2 – Symbolic classification of combustible materials**

#### B.2 Use of materials

The symbols given in table B.3 shall be used to indicate the designated use of materials (see also SANS 10400-A for occupancy classifications).

**Table B.3 – Limitations on the use of materials**



## Identification Occupancy description (use or limitation)

1		2
A	Application identification	Description of permissible application
1	H	Horizontal (under-roof) only
N	V HV	Vertical (side cladding) Horizontal and vertical
o		

### limitation

- B1 and 2 All occupancies, except for the proviso listed in SANS 10400-T
- 3 All single-storey and double-storey buildings, except A1, C1, C2, E1, E2, E3, H1 and H2
- 4 All single-storey buildings, except A1, C1, C2, D1, E1, E2, E3, H1 and H2
- 5 All single-storey buildings, except A1, A2, A3, C1, C2, D1, E1, E2, E3, F1, F3, G1, H1, H2, J1 and J4
- 6 Not acceptable for any application

### B.3 Application of materials

The symbols given in table B.4 shall be used to indicate the designated application of materials.

**Table B.4 – Symbolic application identification of materials**

### B.4 Example of product identification

A product shall be identified as follows:

Combustibility / surface fire properties / use / application

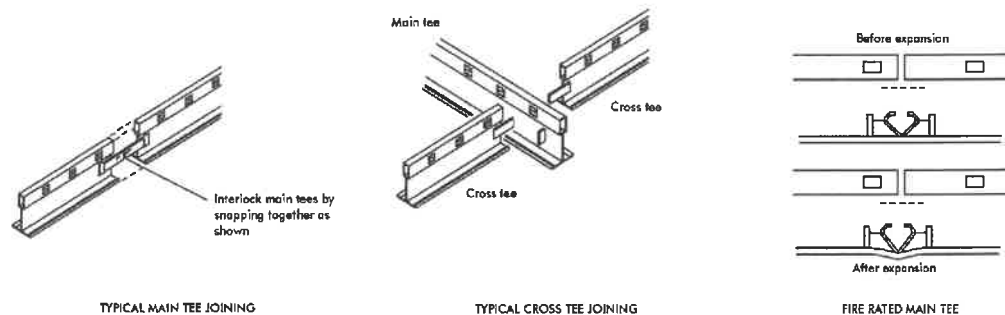
For example: **B/B1/2/HV FIRE RATED**

“Fire – resistance ratings” is the term used to indicate the performance of a constructed ceiling system. It should be noted that no one component is fire rated it is the system that is when tested in accordance with SABS 10177: Part II.

Specified samples of these systems are tested and then certified in their entirety. This fire rating is expressed in time e.g. F30 minutes/ ½ hour; F60 minutes/ 1 hour; F90 minutes/ 1½ hour; F120 minutes/ 2 hour. Fire rating of above 2 hours is rare, manufacturers will be able to assist when longer fire rated times are required.



## FIRE RATED CEILING SYSTEM



### Light fittings and other items

Light fittings, speakers, air grilles etc. all influence the fire rating of ceilings. Where the fire rating is the important factor, it is advisable to request the assistance of the ceiling tile and grid manufacturer.

## 11. HUMIDITY

Modern ceiling panels are all designed and composed to improve sag resistance. Testing of the ceiling panels typically entails samples being placed into climate chambers where adverse conditions are simulated for a period of time. The typical time period is usually up to 48 hours with readings taken at 24 and 48 hours. The temperature and humidity may vary according to request. In South Africa the tests are taken at 95% humidity, at 32° Celsius, over 48-hour period. The international classification for sag (ASTM C473) classifies any product with sag of less than 3.0mm after 48 hours under these conditions, as a high-performance product.

Mineral fibre ceiling tiles are manufactured to different humidity specifications, which may range from 70% up to 95% and, in exceptional cases, to 99%. Mineral fibre tiles require that the humidity in buildings must be stabilized before these types of tiles are inserted into the ceiling grid. It is important to note that this will affect the guarantee/warranty of these ceiling tiles. Adequate ventilation and/or insulation must be provided to prevent condensation in the plenum.

## 12. LIGHT REFLECTANCE

Light reflectance is the ability of a surface to reflect light back into a space. The light reflectance of a variety of ceiling tiles measured in South Africa indicated a reflectance range from 0.8 to 0.92, with the mean being 0.84 from a sample group of 30 tiles. A reflectance of 0.85 is considered to be high.

## 13. BAFFLES, SIGNS, LIGHT FITTINGS AND APPENDAGES

Baffles are used to assist with acoustic control in open plan offices. Signs are used to offer information. Appendages may include a range of items, such as promotional items suspended from ceilings in retail stores for a limited period.

### Important points to note are:

Baffle/sign weights should not place undue stress on the ceiling grid. Where the weight of the baffle/sign exceeds 10kg, extra suspension support must be added to the ceiling grid. Suspension of the baffle/sign should always be from the main tee.

Suspension should not be more than 300mm from a suspension point/wire used to suspend the grid system from which the baffle/sign is suspended.

Additional suspension is required where recessed types of luminaires are suspended from the ceiling grid.

Where light fittings have a known mass of 10kg or more, additional suspension should be used on the grid.

**Any unsupported weight that causes the grid to deflect more than 1/360 of the span is not allowed and should be suspended separately.**

## 14.1 THERMAL INSULATION

### Benefits

Insulation is the cost effective way to improve the energy efficiency of a home or a building. Insulation of the building envelope helps keep heat in during the winter and out in summer to improve comfort and save energy. Insulation can add additional benefits such as acoustics and waterproofing.

## 15 CLIMATIC ZONES

Design for comfort and energy efficiency is influenced by climatic conditions. To achieve the best results, building design and construction materials should be appropriate to the climate of a region. While each of the six climate zones have different heating and cooling needs, the same principles of energy efficient design apply, with their application varying slightly, e.g. different levels of insulation or thermal mass or variations in window sizes, orientation and shading.

### Recommended Insulation levels

A national framework is in the process of being developed for energy ratings in houses and buildings which will address insulation as one of several components. Government regulations will be introduced specifying minimum insulation levels for all new homes and buildings built in South Africa. Small alterations or renovations to existing buildings requiring a building permit may also have to comply with the regulations.

The following proposed deemed-to-satisfy rules are to be applied in the event that mechanical/electrical Engineers are not employed by the building owner at the design state of the building.

### Deemed-to-satisfy rule for energy efficiency in roof and ceiling construction

Climate zones	1	2	3	4	5	6
Minimum required Total R-Value (for roof solar absorptance of more than 0.55) m <sup>2</sup> K/W	3.7	3.2	2.7	2.2	1.7	1.2

1. The roof light shaft index is determined by measuring the distance from the centre of the shaft at the roof to the centre of the shaft at the ceiling level and dividing it by the average internal dimension of the shaft opening at the ceiling level (or the diameter for a circular shaft) in the same units of measurement.
2. The total area of roof lights in the combined area for all roof lights serving the room or space.
3. The area of a roof light in is the area of the roof opening that allows light to enter the building.
4. The thermal performance of an imperforate ceiling diffuser may be included in the Total R-value of a roof light.

## 14.2 ACOUSTIC INSULATION

### Sound absorption

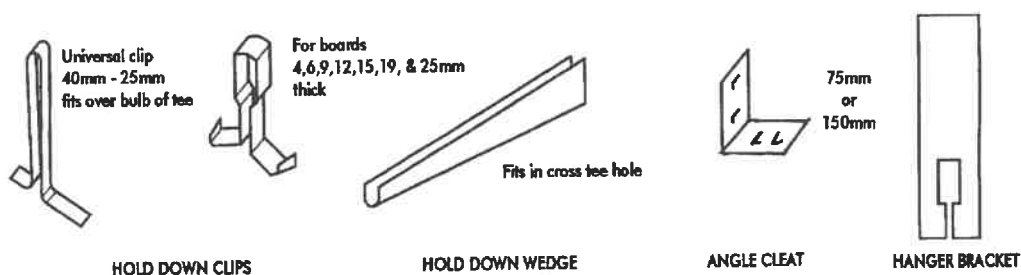
It is the loss of sound energy and is often created by introducing acoustically absorbing products into a room which is considered as too “reflective or reverberant” for its intended use. Refer Annex 4 for further information.

## 15. HOLD DOWN CLIPS (at the discretion of the Specified/Architect)

Hold down clips are used to assist with the acoustic performance of ceiling tiles, i.e. by holding the tiles in place.

Hold down clips assist by keeping the tiles in place where excess updraft is experienced in a building.

### TYPICAL HOLD DOWN FITTINGS



## 16. ACCURACY

As absolute accuracy exists only in theory, tolerable degrees of inaccuracy have to be accepted in practice.

SANS 10155-1980 – Code of Practice for Accuracy in Buildings specifies permissible deviations in elements or components above foundations in its Table 4 as follows:

DESCRIPTION	Permissible deviation in IN mm - Grade
Position on plan of any edge or surface measured from the nearest grid line or agreed centre-line	±15
Linear (other than cross-section) dimensions	±20
Cross-Section dimensions	-5 + 15
Level (deviation from design level with reference to the nearest transferred datum (TD) of the upper or lower surface, as may be specified, of any slab or other element or component)	-15 + 5
Vertical, per metre of height, subject to a maximum of	5 50
Out of squareness of a corner or of an opening of an element such as a column for short side of length	±5
a) up to and including 0.5m	±15
b) over 0.5m and up to and including 2m	±20
c) over 2m and up to and including 4m	
Exposed surface	5
a) Flatness of plane surface	5
b) Abrupt changes in a continuous surface	
Exposed surface to be plastered	10
a) Flatness of plane surface	5
b) Abrupt changes in a continuous surface	

## 17. SAFETY

Ceiling systems are not designed to carry excess or additional structural loads. It is therefore recommended that catwalks are installed where access is required to other services above the ceiling, and that personnel walkways are installed above the installed ceiling.

It is recommended that appropriate suspension is used to support these loads independently of the ceiling system. This applies also to bulkheads, signs and other appendages. Any load that is installed below the ceiling should be independently supported.

## 18. ACOUSTIC



### **Sound leaks – General**

These are identifiable sound leak patch such as openings, gaps and cracks as well as conduit, cable. Ventilation and piping runs which allow airborne sound to be transmitted.

Apart from badly sealed doors, windows and openings between walls and floors or ceilings other items of concern include:

Recessed lighting installed in suspended ceiling which share a common plenum with adjacent rooms.

Keyholes of doors.

Louvers in doors.

Air vents in walls.

Suspended ceiling which pass over a dividing wall or partition.

### **Facings General**

Some insulation products require a membrane or porous facing for protection and/or appearance. The facing chosen must allow the sound waves to pass easily through the product and enter the acoustic insulation, as an example pine perforated facings. This normally requires discussion between the professional team to arrive at a suitable facing which is acceptable to all. (Performance, appearance, safety, durability and costs.)

### **Sound Isolation**

It is the design and treatment to walls, floors, doors, roofs, ceilings, windows and openings, etc. to reduce the amount of sound transmitted through these items to a level which is desirable for the room's intended use

## **19 CEILLINGS**

It is only required if the type of roof and roof system do not already provide adequate sound isolation. Mass is normally a requirement here and a concrete slab is generally very effective. (Subject to structure borne noise having been addressed).

Alternatively, a multi-laminate ceiling requires to be installed which will normally include heavy density, uniformly flat, products together with acoustical absorbing boards or blankets "sandwiched" in between.

Subject to the function of the room it is often advisable to also install a full, or semi, acoustical facing or a ceiling using acoustical ceiling tiles or materials which have sound absorbing qualities.

The acoustical design will vary dependent on the type of venue.

## **20 VENTILATION DUCTS**

A considerable amount of noise can be transmitted via A.C. and ventilation ducting. Often the noise from in-line fans exacerbates this problem. Fans should be installed on flexible mountings. The fan casing may also require to be insulated.

Internal and external lining of the ducting and/or the addition of noise attenuators may be required to reduce noise levels.





## **KIMBERLEY DPWI REGIONAL OFFICE: REPLACEMENT OF AIR CONDITIONING SYSTEM**

### **SPECIFICATION FOR THE MECHANICAL AND ELECTRICAL INSTALLATION**

#### **COMPREHENSIVE CONTRACT**

## **ELECTRICAL INSTALLATIONS: PART B**

### **AIR CONDITIONING AND ELECTRICAL INSTALLATIONS**

#### **GENERAL TECHNICAL SPECIFICATION**

#### **NOT INCLUDED IN THIS DOCUMENT**

**This entire specification and Bills of Quantities shall be read in conjunction with the Electrical/Mechanical General Technical Specification of the Department of Public Works, which is available on request.**

# **KIMBERLEY: DPWI KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM**

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### **SECTION 1.3**

Schedule of Price Variations

# **KIMBERLEY: KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM**

## **ELECTRICAL COMPREHENSIVE CONTRACT**

### **PART B**

#### **SECTION 1.1**

##### **GENERAL SPECIFICATIONS ELECTRICAL INSTALLATION**

# KIMBERLEY: DPWI – NC KIMBERLEY REGIONAL OFFICES REPLACEMENT OF AIRCONDITIONING SYSTEM

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#### **1.1 STANDARD SPECIFICATIONS, ACTS, REGULATIONS AND BY-LAWS**

Wherever any reference is made to the South African National Standard (SANS) and the British Standard specification (BS) in this reference shall be deemed to read "SANS or equivalent standard" and "BS or equivalent standard" respectively.

The following shall apply to this contract:

- (a) SANS 10142-1, 2017: The Wiring of Premises.
- (b) SANS 204: Energy Efficiency in Buildings
- (c) SANS 10114-1: Interior lighting Part 1: Artificial lighting of interiors.
- (d) SANS 10114-2: Emergency Lighting
- (e) SANS 10389-1: Exterior Lighting Part 1 – Artificial Lighting of exterior areas for work and safety
- (f) SANS 10098-1: Public Lighting Part 1 - The Lighting of Public Thoroughfares
- (g) SANS 10098-2: Public Lighting Part 1 - The Lighting of Certain Specific Areas of Streets and Highways.
- (h) SANS 10292: Earthing of Low Voltage Distribution Systems.
- (i) SANS 10313: Protection of structures against lightning
- (j) SANS 10400: The Application of the National Building Regulations
- (k) Act 85 of 1993: Occupational Health and Safety Act

#### **1.2 NOTICES AND FEES**

The contractor shall make all arrangements and give all notices required by, and pay all necessary fees, including any inspection fees, due to the local Supply Authority relating to the connection, alteration or upgrade of the electricity supply to the premises.

The actual net amounts paid will be refunded to the contractor upon receipt of proof of payment.

Provisional amounts to cover these costs are allowed for in the Bill of Quantities and an allowance is made for the tenderers to price for attendance, profit and all incidental costs relating to this requirement.

#### **1.3 SCHEDULE OF FITTINGS**

In all instances where schedules of lights, socket outlets and power points are attached or included on the drawings, these schedules are to be regarded as forming part of the specification.

#### **1.4 QUALITY OF MATERIALS**

Only new, unused equipment and materials of prescribed quality shall be used and all materials shall be subject to the approval of the Employer's Agent.

Wherever applicable material is to comply with the relevant South African National Standard specifications, or to British Standard Specifications, where no SANS specifications exist.

Materials must be of South African manufacture wherever possible.

#### **1.5 DELAY**

If the electrical sub-contractor's work should cause any delay to the building operations, he will be held responsible for any claims arising out of such delay.



## **1.6 MAINTENANCE PERIOD AND RETENTION MONEY**

The maintenance period mentioned in the Conditions of Contract will also apply to the work covered by this Part B, calculated from the date the installation has been taken over by the Employer.

Payment of the retention money mentioned in the Conditions of Contract will be effected after the lapse of the maintenance period stated provided the installation has been in satisfactory working order during this period.

## **1.7 CONDUIT AND CONDUIT ACCESSORIES**

The indoor installation may be in black enamelled conduit or PVC conduit. All conduits shall be concealed in the building work where possible. Black enamelled conduit shall be screwed or plain end.

Should for some reason it not be possible to conceal conduit in the building work requiring the conduit to be surface mounted, only steel conduit may be used, secured neatly in vertical and horizontal positions by means of galvanised steel spacer saddles.

Steel conduit exposed to damp or weather conditions shall be galvanised to SANS 121.

Galvanised draw wires must be provided in all conduits provided for other services.

All steel conduit joints in concrete slabs and all running joints must be painted.

No chasing by hammer and chisel will be accepted. Slots for conduits must be cut by using power cutting disk tools where necessary.

Bushes on metal conduit shall be of brass only.

All outlet box cover plates must be metal and steel outlet boxes must be hot-dipped galvanized to SANS 121.

Where cavity walls or face brick walls are encountered deep back-to-back (one end closed) wall boxes must be used.

Blank cover plates on round outlet boxes must be fixed with flat head brass screws and a gasket to seal the box.

Blank cover plates on 100 x 100 mm outlet boxes must be fixed with two countersunk chrome screws.

Where outlet boxes or draw boxes are mounted on finished surfaces the electrical contractor shall take care that such outlets are mounted symmetrically. It will not be sufficient to scale the position of any outlet off the drawings. No extra payment will be allowed where the outlets are not mounted symmetrically and have to be changed.

Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

All PVC conduits shall be installed in accordance with Appendix C of SANS 950 as well as SANS 10142-1.

Non-metallic conduit or conduit boxes shall not support luminaries and other fittings. These fittings shall be secured to the surrounding structure in a way that is acceptable to the Employer's Agent.

Surface mounted conduit shall be supported and fixed with saddles with a maximum spacing of 1,5 m, even in roof spaces. (Refer to SANS 10142-1, 2017).

The contractor shall supply and install all additional supporting timbers required.



It shall be possible to rewire the completed installation in the future without undue difficulty.

Non-metallic conduit and fittings shall not be used under the following conditions:

- (a) Outside a building (unless protected, or sheltered under eaves).
- (b) For mechanical load bearing.
- (c) Where it may be subjected to temperatures below  $-10^{\circ}\text{C}$  or above  $70^{\circ}\text{C}$  for prolonged periods.
- (d) As primary electrical insulation.
- (e) In areas where it may be subject to mechanical damage.
- (f) For applications other than those for which it is designed.

### **Painting of Conduits**

Exposed conduit may be painted with normal oil or PVA paints, but care must be taken to ensure that the paint used does not contain any component that will soften or have any other detrimental effect on the materials from which the conduit and fittings are manufactured.

### **Connecting of Conduit to Metal Equipment/Components**

When any part of a non-metallic conduit system has to be connected to metal equipment or components (e.g. switchboard, surface socket-outlet or switch box, existing metallic conduit system, etc.) fittings and couplings manufactured specifically for this purpose must be used. Non-metallic conduit must not be threaded to fit metallic connectors.

### **Bends**

The technique applied in bending conduit shall result in a smoothly bent conduit without conduit surface ripple, cracking or flattening of the conduit. Suitable bending tools shall be applied to achieve this where manual methods are inadequate. Bends shall comply with SANS 10142-1, 2017. Conduits shall be secured immediately following bending.

### **Adhesive Joints**

All adhesive joints must be made in a clean dry area. The surfaces of all components to be bonded must be dry and clean. The technique applied in jointing conduit shall ensure that a mechanically sound and watertight joint with an insertion depth equal to half the length of the coupling is achieved, and that no excess jointing adhesive is squeezed into the conduit or accessory.

**NOTE:** Solvent adhesives containing highly volatile liquids and their containers should not be left open.

### **Cutting of Conduit**

A fine-tooth hacksaw shall be used to cut conduit to the required length. Each cut end shall be square and free from swarf, burrs and loose material. When determining the length of conduit to be cut, allowance must be made for the length of couplings or



accessories attached to the conduit. Incorrect determination will cause bulging of the conduit or insufficient joint length.

#### **1.8 CONDUIT IN ROOF SPACES**

In roof spaces, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit shall be secured at intervals not exceeding 1,5 m by means of saddles fixed to the roof timbers by means of screws or acceptable clout nails.

In the case of repairs and renovations, conduit runs from a distribution board shall, where possible, terminate in fabricated sheet steel draw boxes installed directly above or in close proximity to the boards.

#### **1.9 WIRING**

Except where otherwise specified in the specifications or indicated on the drawings, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduit is to be clear of moisture and debris before wiring is commenced.

Wiring of the installation shall be carried out in accordance with the latest edition of the Wiring Code (SANS 10142-1, 2017). It is a specific requirement of this contract that earth conductors be provided and drawn into the conduit with the main conductors to all points, including all lighting points throughout the installation, irrespective of the type of conduit used.

Wiring for lighting circuits is to be carried out with 2.5 mm<sup>2</sup> conductor and a 2.5 mm<sup>2</sup> earth conductor. For socket outlet circuits the wiring shall comprise 4.0 mm<sup>2</sup> and a 2.5 mm<sup>2</sup> earth conductor. In certain instances, as will be directed in the specification or shown on the drawings, the sizes of the aforementioned conductors may have to be increased for specified circuits.

Sizes of conductors to be drawn into conduits in all other instances, such as feeders to distribution boards, power points etc, shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be in accordance with the Wiring Code.

The stipulations concerning the installation of earth conductors to a certain maximum length for a given size of conductor as set out in the "Wiring Code" are to be strictly applied.

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

The wiring shall be done in PVC insulated 300/500V grade cable to SANS 1507.

Where cable ends connect to switches, fittings, etc. the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

Insulated heat-resistant wiring shall be used to connect totally enclosed luminaires and other fittings where excessive temperatures are likely to occur.





## **1.10 SWITCHES AND SOCKET OUTLETS**

All switches and switch socket outlet combination units shall be of the same manufacture and pattern throughout the installation, and shall comply with the SANS 10142-1, 2017 and must be approved by the Employer's Agent.

No other than 16A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed with the centre line at 1.4 m above finished floor level and all socket outlets with the centre line at 300mm above finished floor level or, where applicable, between a worktop and window sill in such manner that it is either totally within or totally above any tiled area, unless a specific mounting height is indicated on the drawings or specified in the Project Specification.

Screws longer than 30mm to affix light switch or switch socket cradles the draw box will not be accepted.

## **1.11 SWITCHGEAR**

Switchgear, which includes circuit breakers, metal-clad switches, interlocked switch-plug units, contactors, time switches, etc., is to comply with the SANS requirements.

## **1.12 DISTRIBUTION BOARDS**

### **General**

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the Employer's Agent before installation.

In all instances where provision is to be made on boards for the Supply Authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

Two spare 25mm dia. and three spare 20mm dia conduits must be supplied from all distribution boards to roof spaces.

Three sets of factory drawings on all distribution boards must be submitted for approval before manufacture of the distribution boards commence.

The Employer's Agent must be notified at least two weeks in advance of the completion of the distribution boards in order that an inspection may be carried out before delivery.

### **Construction**

Apparatus and requirements by the Supply Authority are not indicated on the distribution board diagrams and schedules. It is expected of the Electrical Contractor to install all such apparatus, accessories and systems as may be required by the Supply Authority, as part of the electrical contract price.

Busbar stubs must be provided where more than one conductor terminates on equipment.

### **Installation**

All distribution boards shall be supplied and installed in the positions shown on the drawings.

All distribution boards must be flush mounted unless otherwise indicated, and are to be installed with the top of the board 2.0 m above the finished floor level.