

APPENDIX 1: SCHEDULE A/B

TECHNICAL REQUIREMENTS

1.1 GENERAL

The technical requirements of this section specified under 'Schedules A and B' shall form part of the *Employer's* enquiry documentation. Schedule B shall be completed by the *Contractor* and submitted with his tender.

1.2 SCHEDULES A, B, C AND D

Schedule A: Particular of *Employer's* Requirements

Schedule B: Guaranteed technical particulars of equipment offered in response to Schedule A requirements by the *Contractor*.

Schedule C: Deviation Schedule

Schedule D: Recommended Spares List

1.3 INSTRUCTIONS

- 1.3.1 Where the *Contractor* does not fully comply with the *Employer's* requirement, any deviations must be clearly indicated in Schedule B and listed in the Deviation Schedule (Annexure B).
- 1.3.2 Where there is a need to substantiate or further describe an item in Schedule B, especially in instances of non-compliance with Schedule A, particulars are furnished on a separate sheet clearly stated on Schedule C.
- 1.3.3 If a blank space is left in Schedule B next to certain requirement specified in Schedule A, this constitutes a confirmation that the tender does not comply with that specific requirement.
- 1.3.4 Where *** is indicated for an item in Schedule A, the *Contractor* is required to fill in the appropriate information in Schedule B, for the equipment offered.

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Schedule A: Particulars of *Employer's* Requirements**Schedule B: Guarantees and Technical Particulars of Equipment and Materials Offered**

Item	Technical Data	Schedule A	Schedule B
1.	Design Data for Air Compressors		
1.1.	Number of air compressors	4	
1.2.	Rated Capacity (Nm ³ /min)	12	
1.3.	Maximum Working Pressure (kPa)	8000	
1.4.	Suction Pressure (kPa)	88	
1.5.	Suction temperature (Relative Humidity = 50%)	40°C	
1.6.	Type of Compressor	Reciprocating	
1.7.	Compressor Speed (rpm)	735	
1.8.	Stages/ Cylinders	3	
1.9.	Driving method	Motor, direct coupled	
1.10.	Compressor cooling – Closed Loop	Water/Coolant-Cooled	
1.11.	Closed Loop pressure maintenance	Header Tank/expansion vessel	
1.12.	Raw water/Coolant heat exchanger	12 bar Shell & Tube Type	
1.13.	Coolant circulation pump (per compressor)	Centrifugal	
1.14.	Raw Cooling water capacity (T/Hr) at 25°C per compressor	16	
1.15.	Max cooling water differential pressure across compressor (kPa)	290	
1.16.	Compressor dismantled and reassembled to position		
1.17.	Initial oil supply	Yes	
1.18.	Air intake filters	Yes	
1.19.	Intercoolers and final aftercoolers	Yes	
1.20.	Safety relief valves, all stages – air side	Yes	
1.21.	Water jackets relieve valves – cooling water side	Yes	
1.22.	Locally mounted gauges on compressors	Yes	
1.23.	Pneumatic operated load and unload valves	Yes	
1.24.	Vibration dampers at compressor bases	Yes	
2.	Electrical Technical Data		
2.1.	LCP Motor starter circuit Segregated	Yes	
2.2.	Rated frequency (Hz)	50	

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Item	Technical Data	Schedule A	Schedule B
2.3.	Rated Voltage(V)	400	
2.4.	Phases	3-phase AC	
2.5.	Rated speed (rpm)	586	
2.6.	Full load current (A)	466	
2.7.	Starting current (A)	2796	
2.8.	Starting Time (< 1 s)	1.0	
2.9.	Circuit size (A)		
2.10.	Contactor Type	***	
2.11.	Contactor	***	
2.12.	MCCB rating (A)	***	
2.13.	Motor output (KW)	220	
2.14.	Motor Starting method	Star-Delta	
2.15.	Load (A)	243	
2.16.	Insulation	F Class	
2.17.	International Efficiency class code (e.g., IE1, IE2, IE3)	IE1	
2.18.	Cores per cable	3	
2.19.	Core area (mm ²)	***	
2.20.	Motor General Information:		
2.21.	Applicable SANS standard (Code)	SANS 60034, SANS 1804	
2.22.	Applicable Eskom Specification (Number)	240-57617975	
2.23.	Motor manufacturer		
2.24.	Motor life expectancy (years)	>25	
2.25.	Motor starter circuit for close loop cooling water motor to be included within the panel	Yes	
2.26.	Motor output (kW)	***	
2.27.	Starting method	DOL	
2.28.	Circuit size (A)	***	
2.29.	Load (A)	***	
2.30.	MCCB rating (A)	***	
2.31.	Contactor Type	***	
2.32.	Cores per cable	***	
2.33.	Core area (mm ²)	***	
3.	Piping and Fittings		

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Item	Technical Data	Schedule A	Schedule B
3.1.	Air discharge piping interfacing to existing plant receivers	Yes	
3.2.	Cooling water inlet flange detail	3" ASA 150 SO RF	
3.3.	Cooling water outlet flange detail	3" ASA 150 SO RF	
3.4.	Cooling water piping rated design pressure (kPa)	1200	
3.5.	Condensate/ Unloading drain header pipe size	200NB	
3.6.	Maximum Rating & size for Compressed air outlet valve	600LB, 1½"	
3.7.	Compressed air discharge piping size & schedule	1½", SCH 80	
3.8.	Compressed air discharge flange size	1½", 600LB WN	
	C&I Technical Data		
4.	Operational Requirements (Modes):		
4.1.	Manual		
4.1.1	The operator is allowed to Start and Stop the compressor from the Local Control Panel (operation interlocked with Final Delivery and/or System pressure).	Yes	
4.2	Automatic		
4.2.1	The compressors operate on demand from the measured final delivery/system pressure.	Yes	
4.2.2	The compressors' running regime is determined by remote Start/Stop signals (digital inputs).	Yes	
4.2.3	The compressors' running regime is determined by 4 analogue pressure transmitter signals (4-20mA) from 4 different air receivers. Start and stop values are derived depending on a Main/Standby mode selection.	Yes	
4.3.	Points of Control:		
4.3.1	Local (LCP)		
4.3.2	Local/Off/Remote Selection: <ul style="list-style-type: none"> Local/Manual – As described below Off – Out of service Remote – As described below 	Yes	
4.3.3	Start and Stop the compressor (operation interlocked with Final Delivery and/or System pressure).	Yes	
4.3.4	Start and Stop the closed loop CW Circulating Pump.	Yes	
4.3.5	Emergency Stop facility (Push-button).	Yes	
4.3.6	Reset and clear alarm and fault conditions.	Yes	
4.3.7	Unload operation (maintenance).	Yes	
4.3.8	Monitoring capability and local status indications		

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Item	Technical Data	Schedule A	Schedule B
4.3.8.1	<ul style="list-style-type: none"> Compressor current gauge 	Yes	
4.3.8.2	<ul style="list-style-type: none"> Applicable unit blowdown air receiver pressure gauge 	Yes	
4.3.8.3	<ul style="list-style-type: none"> Final stage air temperature gauge/indication 	Yes	
4.3.8.4	<ul style="list-style-type: none"> Final stage air pressure gauge/indication 	Yes	
4.3.8.5	<ul style="list-style-type: none"> Compressor running hours meter 	Yes	
4.3.8.6	<ul style="list-style-type: none"> Compressor start counter 	Yes	
4.3.8.7	<ul style="list-style-type: none"> Compressor Healthy/Ready-to-Start 	Yes	
4.3.8.8	<ul style="list-style-type: none"> Compressor running indication 	Yes	
4.3.8.9	<ul style="list-style-type: none"> Compressor off indication 	Yes	
4.3.8.10	<ul style="list-style-type: none"> Compressor fault indication 	Yes	
4.3.8.11	<ul style="list-style-type: none"> Cooling water flow low indication 	Yes	
4.3.8.12	<ul style="list-style-type: none"> Lube oil pressure low indication 	Yes	
4.3.8.13	<ul style="list-style-type: none"> Air temp high indication 	Yes	
4.3.8.14	<ul style="list-style-type: none"> Pneumatic air not ready indication (if applicable) 	Yes	
4.3.8.15	<ul style="list-style-type: none"> Lube Oil Level low indication (if applicable) 	Yes	
4.3.8.16	<ul style="list-style-type: none"> Compressor 380VAC Unhealthy (Isolated/Racked out/Not-in-Auto) 	Yes	
4.3.8.17	<ul style="list-style-type: none"> Lamp Test (if applicable) 	Yes	
4.3.2	Remote from SCADA		
4.3.2.1	The compressors can be stopped and started from the plant SCADA	Yes	
4.3.3	Control Panel:		
4.3.3.1	Number of Panels	4	
4.3.3.2	Segregated from motor starter circuits	Yes	
4.3.3.3	Cabinet IP rating	IP55 (or better)	
4.3.3.4	Double door front entry, combinable form factor enclosures	Yes	
4.3.3.5	Floor Standing	Yes	
4.3.3.6	Mild steel material: <ul style="list-style-type: none"> Frame: 1.5 mm painted steel. Front and rear door: 2 mm painted steel. Side panels: 1.5 mm painted steel. Mounting plate: 3 mm galvanized steel. Gland plates: 1.5 mm galvanized steel, fixed by C-shaped clips, fixed with screws, providing electrical continuity through the clips/screws. 	Yes	

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Item	Technical Data	Schedule A	Schedule B
4.3.3.7	Frame – Seam welded reversed open profiles with 25 mm hole pattern, according to DIN 43660. Including integrated external hole pattern.		
4.3.3.8	Doors – Mounted with four hinges allowing left- or right-hand opening (including door frame with 25 mm hole pattern and steel door retainer).		
4.3.3.9	Mounting Plate – Double folded and slides into position (depth adjustable).		
4.3.3.10	Earth Stud.		
4.3.3.11	Lock/Handle: 4-point locking system. Does not interfere with the enclosure inner space. Standard double-bit lock with 3 mm insert. Standard inserts, cylinders, and lift handles.		
4.3.3.12	Top entry – preferably components are mounted in the front half of the panel and cabling/wiring at the rear half (back-to-back plates). This is to prevent component damage should water ingress occur	Yes	
4.3.3.13	Finish – The cabinets are dipcoat primed and powder coated in RAL 1015 light ivory colour.	Yes	
4.3.3.14	Lifting – Moulded galvanised-steel eyebolts/lifting brackets to connect to the framework of the enclosure, in line with the uprights.	Yes	
4.3.3.15	Display meters	24V DC Supply	
4.3.3.16	The new local control panels have 24VDC insulation monitoring and alarming capability.	Yes	
4.3.3.17	All external wiring will align with Eskom standards.	Yes	
4.3.3.18	Panel wiring according to Eskom Control & Instrumentation Standard	Eskom Standard 240-56355815	
4.3.3.19	Tags according to Eskom Plant Labelling Standard	Eskom Standard 240-71432150	
4.3.3.20	All control panel design will align with Eskom standards.	Yes	
4.3.3.21	100mm high steel plinth (base plate) with levelling ability, painted with epoxy-polyester resin, RAL 7022 grey.	Yes	
4.3.3.22	Panel Light – Door switch with motion sensor On/Off control.	Yes	
4.3.3.23	Socket Supply, earth leakage protection, form factor.	220V AC	
4.4	Supply Voltages		
4.4.1	24V DC monitoring and alarm	Yes	
4.4.2	220V DC monitoring and alarm	Yes	
4.4.3	220V AC monitoring and alarm	Yes	
4.4.4	380V AC monitoring and alarm	Yes	
4.5	Panel Wiring		
4.5.1	PT 100 a dedicated shield earthing	Yes	
4.5.2	4 – 20mA dedicated shield earthing	Yes	

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Item	Technical Data	Schedule A	Schedule B
4.5.3	Spare cores to be earthed in controller panel	Yes	
4.6	PLC		
4.6.1	Number of PLC's	4	
4.6.2	The PLC logic program is done according to international standard.	IEC 61131-3	
4.6.3	Each PLC is dedicated to one compressor.	Yes	
4.6.4	The PLC is accessible via engineering software that can perform functions such as: <ul style="list-style-type: none"> I/O card configuration and system configuration Logic programming Fault/failure diagnostics 	Yes	
4.7	I/O Modules		
4.7.1	Temperature input cards	PT100	
4.7.2	Analogue input and output cards	4 – 20mA	
4.7.3	Digital input and output cards. Output driving coils must be fitted with free-wheeling diodes.	24V DC	
4.7.4	Wetting power supply monitoring per card.	Yes	
4.8	Instruments:		
4.8.1	Compressor Instruments		
4.8.1.1	PT100 air temperature sensors for each compressor stage	Yes	
4.8.1.2	Each compressor stage air temperature displayed on locally (gauges)	Yes	
4.8.1.3	Air pressure transmitter for each compressor stage	Yes	
4.8.1.4	Air pressure for each compressor stage displayed locally (gauges)	Yes	
4.8.1.5	Final Delivery / System air pressure transmitter	Yes	
4.8.1.6	Final Delivery / System air pressure displayed locally (gauge)	Yes	
4.8.1.7	Compressor lubrication oil pressure transmitter	Yes	
4.8.1.8	Compressor lubrication oil pressure displayed locally (gauge)	Yes	
4.8.1.9	Compressor CW Flowmeter	Yes	
4.8.1.10	Compressor CW Flow locally displayed (gauge)	Yes	
4.8.1.11	Condensate release/unloader/drain valves on each stage (24VDC/220VDC)	Yes	
4.8.1.12	Cylinder unloader valves for each compression stage (Pneumatic)	Yes	

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Item	Technical Data	Schedule A	Schedule B
4.8.1.13	CW inlet solenoid valve (220VDC)	Yes	
4.8.1.14	Pneumatic control air pressure transmitter	Yes	
4.8.1.15	Pneumatic control air pressure locally displayed (gauge)	Yes	
4.8.1.16	Flow transmitter preferred type	Krohne DWM 2000	
4.8.1.17	Pressure transmitters preferred type	Yokogawa EJX 530	
4.8.1.18	Pressure transmitters tubed out to local stand	Yes	
4.8.2	Closed-loop Cooling System Instruments (X4)		
4.8.2.1	PT100 temperature sensor for coolant inlet	Yes	
4.8.2.2	Coolant inlet temperature displayed locally (gauge)	Yes	
4.8.2.3	PT100 temperature sensor for coolant outlet	Yes	
4.8.2.4	Coolant outlet temperature displayed locally (gauge)	Yes	
4.8.2.5	Pressure transmitter for coolant inlet	Yes	
4.8.2.6	Coolant inlet pressure displayed locally (gauge)	Yes	
4.8.2.7	Pressure transmitter for coolant outlet	Yes	
4.8.2.8	Coolant outlet pressure displayed locally (gauge)	Yes	
4.8.3	Open loop Cooling System Instruments		
4.8.3.1	PT100 temperature sensor for heat exchanger inlet – displayed locally	Yes	
4.8.3.2	PT100 temperature sensor for heat exchanger outlet – displayed locally	Yes	
4.8.3.3	Heat exchanger inlet pressure – displayed locally (gauge)	Yes	
4.8.3.4	Heat exchanger outlet pressure – displayed locally (gauge)	Yes	
4.8.3.5	Heat exchanger CW Flow – displayed locally (gauge)	Yes	
4.9	Integration of Control System with SCADA:	Yes	
4.9.1	Preferred Communication Protocols in order of preference	IEC 60870-5-104	
4.9.2		IEC 61850	
4.9.3		OPC UA	
4.9.4		OPC DA	
4.9.5		Modbus RTU (Serial)	
4.9.6		Modbus TCP/IP (Ethernet)	
4.9.7		Profibus	

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Item	Technical Data	Schedule A	Schedule B
4.9.8	The <i>Contractor</i> provides a datasheet to indicate which communications protocols and communication interfaces are supported.	Yes	
4.9.9	Communication with plant SCADA System monitored, and alarm raised upon failure.	Yes	
4.9.10	Software signal list provided for SCADA integration.	Yes	
4.10	Cabling and Racking:		
4.10.1	All C&I, communications and electrical power cabling to be supplied.	Yes	
4.10.2	All C&I cabling supplied conforms to the NWS 1525 Standard and dielectric colour code.	Yes	
4.10.3	All cabling is sized according to the design of the system.	Yes	
4.10.4	All cabling is of the flame-retardant type comprising of the blue cable trace colour (Low halogen emission PVC bedding and sheath).	Yes	
4.10.5	All cabling is fitted with Eskom approved cable and core numbers.	Yes	
4.10.6	All cables are supported and earthed over their entire length.	Yes	
4.10.7	<p>If cable racking is required, then it shall be of the following type:</p> <ul style="list-style-type: none"> • Medium Duty Perforated Cable Tray • Material – 1.6mm • Finish – HDG (Hot Dipped Galvanized) • The cable rack will be mounted using pre-galvanized P1000 C-channel. • The C-channel will be secured to the concrete substrate with anchor bolts. • The cable tray will be mounted to the C-channel using spring nuts, mushroom head bolts, and washers for P1000. • The lengths of cable racks will be joined by using HDCT Splice Plates. 	Yes	
4.10.8	Cable racks is supplied and installed according to Eskom standards (GGS0386 – Requirements for Control and Power Cables for Power Stations)	Yes	
4.11	Labelling:		
4.11.1	Core tags used in the panel are of the Graphoplast type, i.e., 23mm tag sleeve and PVC tag (yellow).		
4.11.2	Horizontal Terminal Strip: Tag must read from bottom to top.		
4.11.3	Vertical Terminal Strip: Tag must read from left to right.		
4.11.4	Cable tags used are of the Graphoplast type, i.e., 70x10mm tag sleeve and PVC tag (yellow).		

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Item	Technical Data	Schedule A	Schedule B
4.11.5	Each device installed in the panel must be labelled according KKS standards using Graphoplast Self-adhesive PVC tags (white).		
4.11.6	Each field device must be labelled according to KKS standards using Graphoplast Self-adhesive PVC tags.		
4.11.7	Each field device must be labelled by name/description and measuring range using Graphoplast type, i.e., 70x10mm tag sleeve and PVC tag (yellow).		
4.11.8	All fielded device termination points must be labelled with a 15mm Graphoplast tag sleeve and PVC tag (yellow) as a minimum.		
4.12	Terminations:		
4.12.1	All cable screens are terminated on standard terminals at one end of the cable depending on the design (not on earth terminals).		
4.12.2	Terminals for signal cabling are of the spring-loaded link terminal type. Hook blade lugs are used.		
4.12.3	There is no bare wire or loose strands exposed between a lug and the insulation of the wire to which the lug is crimped.		
4.12.4	Lugs are compatible to the wiring.		
4.12.5	Lugs must fit cross-area of the conductor to which they are crimped. The correct crimping tool is used.		
4.12.6	Bootlace ferrules are acceptable for signal cabling. The correct crimping tool is used (4 di minimum).		
4.12.7	Where two conductors are connected to a terminal, lugs, and ferrules to be fitted in such a manner to allow the wires to be terminated in parallel.		
4.12.8	No more than 2 lugs per terminal.		
5.	Civil and Structures Technical Data		
5.1	Provision for Plinths, if required	Yes	
5.2	Provision for Suitable lifting equipment	Yes	
5.3	Operational Load (kg)		
6.	Power and Control Terminals		
6.1	Type designation	Eskom Standard 0.00/10335	
6.2	Lugs	Eskom Standard 0.00/10335	
6.3	Maximum number of conductors per terminal	Eskom Standard 0.00/10335	
6.4	Terminals Spring loaded	Yes	

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Item	Technical Data	Schedule A	Schedule B
7.	Testing		
7.1	Manufacturing Tests		
7.1.1	All relevant manufacturing tests made available	Yes	
7.2	Factory Acceptance Tests		
7.2.1	Provision made for Factory Acceptance Test (FAT)	Yes	
7.3	Tests on Delivery		
7.3.1	Quality checks for delivery defects	Yes	
7.3.2	Supplier shall ensure all compressor material and equipment are delivered and off-loaded at the power station premises.	Yes	
7.4	Commissioning Tests		
7.4.1	Capacity test	Yes	
7.4.2	Reliability test period (14 days)	Yes	
7.4.3	Power test	Yes	
7.4.4	Noise test	Yes	
7.4.5	Vibration test	Yes	
7.4.6	All test certificates supplied	Yes	
7.4.7	Provision made for Site Acceptance Testing for Protection, Control, and Power cables electrical checks	Yes	
7.4.8	Two set of commissioning spares	Yes	
8.	Training		
8.1	Operating training	Yes	
8.2	Maintenance training	Yes	
8.3	Additional training	Yes	
8.4	Interactive training material	Yes	
9.	Guarantees		
9.1	Compressor efficiency	**	
9.2	Expected compressor life	25 years	
10.	Documentation		
10.1	Project programme compatible with MS Project/Primavera	Yes	
10.2	Safety file	Yes	
10.3	Quality control plans	Yes	

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Item	Technical Data	Schedule A	Schedule B
10.4	Testing procedures and check sheets	Yes	
10.5	Implementation procedures and check sheets	Yes	
10.6	Operating and maintenance manuals	Yes	
10.7	Signed off test certificates	Yes	
10.8	Signed of quality control plans and check sheets	Yes	
10.9	Training materials	Yes	
10.10	Drawing format compatible with Micro-Station	Yes	
10.11	Drawings reflect metric sizes and SI units	Yes	
10.12	List of Drawings as a minimum	Yes	
10.13	Circuit diagrams	Yes	
10.14	Panel assembly diagrams	Yes	
10.15	Logic diagrams	Yes	
10.16	Compressor layout drawings	Yes	
10.17	Compressor system P&IDs	Yes	
10.18	Signal lists	Yes	
10.19	Spares and spares list	Yes	
11.	General		
11.1	Rigging of compressors and equipment into position	Yes	

Note: Shaded Blocks indicate information is **not available**, **applicable**, or **required**.

** No specified limitation

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SCHEDULE C (Deviation Schedule)

The *Contractor* completes the list below as part of the Tender submission.

Any deviations/modifications/alternatives offered shall be listed below with reasons for the departures.

No deviations/modifications/alternative offered will be recognized unless listed on this schedule

If no deviations/modifications/alternatives are offered, this schedule must be marked "None"

Page Ref.	Specification / Schedule / or clause number	Proposed deviation/ modification/ alternative	Cost of deviation or alternative

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SCHEDULE D (Recommended Spares, Tools and Consumable list)

The *Contractor* completes the list below as part of the Tender submission.

Item	Description of spares, special tools and consumables	Quantity	Lead time	Cost
1	Miscellaneous			
1.1.	Mandatory spares			
1.2	Recommended strategic spares			
1.3	Special tools			
1.4	Recommended consumables			

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