SECTION 3 – TECHNICAL SPECIFICATION

3.1 SCOPE OF WORKS

The work to be covered under this specification is listed as follows:

Supply and install all materials, tools, plants, labor and other necessary incidentals for the complete installation, testing, and painting, commissioning and handing over successfully in good operating condition as follows:

a. Compressed air plant, rotary screw compressor-motor, after cooler assemblies, air receiver, filter-refrigerant type dryer assemblies and
   Complete air pipeline reticulation system
b. Electric scissors lifts
c. Electric 4 post vehicle lift
d. Oil Interceptor System
e. Vehicle Washing System
f. Misc. Workshop Equipment

3.2 COMPRESSED AIR SYSTEM

The configuration of the plant shall comprise:

a. Two (2) compressor units
b. One (1) air receiver tanks
c. One (1) pre filter set units
d. One (1) refrigerant air dryer units
e. One (1) after filter set units
f. Pressure release valves, gate valves, ball valves and other necessary components
g. Air compressor discharge coupling devices complete with oil lubricator, filter, pressure regulator and ball valve

3.2.1 Air Compressors

Each sub-assembly shall:

a. Be heavy-duty industrial type

b. Compressor unit: be single-stage, heavy-duty, flood lubricated, asymmetrical lobe, totally integrated rotary screw type. The unit shall be equipped with tapered roller bearings on the discharge end and cylindrical roller bearings on the inlet end for high load carrying capacity.

c. Electrical motor with power requirement 415v/3ph/50 Hz NEMA TC frame, C-flanged, Class F. TEFV, squirrel cage induction type, 40>>C maximum ambient temperature, 1,475 rpm.

d. Starter: IEC style 3-phase auto-transformer, non-reversing - 600 v max. J20 v circuit transformer, terminal strip and 3-phase overload protection in NEMA enclosure.

e. Drive train: Motor in C-flanges mounted to main-drive housing and transmit power directly through the special pinion drive system.

f. Inlet air Filter: I0 micron, 2-stage heavy duty dry type Filter, easily replaceable.

g. Air / fluid housing and separation system (encapsulation design): ASME pressure relief valve, fluid filter, fluid level indicator, high efficiency, long life air / fluid separator element, special isolated shaft seal system to prevent shaft seal leaks, minimum pressure / check valve, pneumatic blow down valve.

h. Cooling / lubrication system: Silicon-based fluid removes heat of compression from compressor unit and is circulated by air pressure differential through air cooled heat exchanger and filter. Equipment include thermal protected TEFC motor driven fan. Full flow fluid filter, fluid thermal bypass valve. Air-cooled after cooler with moisture separator. Maximum 40°C ambient operating temperature.

i. Control: Microprocessor control offer dual control which stop the machine after a preset time in the unload mode. Machine remains in ‘Standby’ mode until system pressure tails to unload setting mode.

j. Instrumentation: Microprocessor control with pressure and temperature inputs provides shutdown indication by means of flashing LEDs on a schematic diagram of the system. A corresponding backlit LCD message display for:

    i) high discharge temperature
    ii) high discharge pressure
    iii) main driver overload

k. Discharge pressure, temperature and load status continuously display without selection. Keypads allow additional selections / functions. Maintenance indication for air / fluid separator also displayed.

3.2.2 Air Receiver

a. The air receiver shall be locally manufactured in accordance to ASME standards with JKKP's test certificate provided to the user.

b. It shall be provided with suitable lifting lugs and mountings feet which permit access to and adequate drainage from the drainage trap.

c. It shall have a volume of up to 350 litres.

d. It shall be designed for a minimum working pressure of 170 psi.

3.2.3 Filtration/Dryer System

The filtration / dryer system shall comprise of two (2) independent sub-assemblies either which may be selected as 'DUTY' whilst retaining the second (2^{nd}) assembly as 'STANDBY' and each assembly to comprise:

a. General purpose pre-filter for removal of fluid water and oil, removes solid particles one (1) micron, remaining oil content of 1 ppm w/w.

b. High efficiency coalescing filter for coalescing fine water and oil aerosols, removes solid particles down to 0.01 micron, remaining oil content of 0.01 ppm w/w.

c. Refrigerant-type air dryer c/w air-to-air and air to refrigerant heat exchanger (s), direct expansion, non-cycling operation type. Units(s) shall be air-cooled type using CFC free R134a or R22 refrigerants.

It shall be rated at the total through out of the compressors(s)

a. Shall satisfy the air quantity, requirement to ISO 8573.1, Class:1.4.1, at standard temperature and pressure.

3.2.4 GENERAL ANCILLARY EQUIPMENT WITHIN PLANT ROOM

3.2.4.1 Relief valves

It shall be fitted either integrally or separately as follow:

a. One (1) on the air receiver tank capable of discharging the total through put of the compressor(s).

b. Downstream of any pressure regulators.

3.2.4.2 Safety valves

The safety valves shall:

a. Be immediately downstream of each line pressure regulator.

b. Conform to BS 1 123 standard.

c. Be capable of discharging the total throughput of the breathing air plant at a max pressure of 650 kPa and reset at 500 kPa minimum pressure.

d. Have a minimum lift pressure of 530kPa.

Non-return valves (NRV)

The non-return valves shall be fitted:

a. Downstream of each compressor / after cooler prior to entering the air receiver tank.

b. After each refrigerant air dryer.

3.2.4.3 Isolating valves

The isolating valve shall be of the manual ball type, located:

a. On each compressor discharge upstream of non-return valve (NRV).

b. Upstream, and downstream of:

   i. Air receiver tank.

   ii. Each individual filter / refrigerant air dryer.

   iii. Each individual pressure regulator / filter / relief valve assembly

c. Upstream of Y-strainer / auto-drain assemblies.

d. At the plant discharges connecting to the general purpose and breathing air pipeline reticulation system.

3.2.4.4 Pressure indicators (PI) / Differential pressure indicators (DPI)

The pressure indicators (PI) / differential pressure indicators (DPI) shall:

- Comply with BS 1780 : 1985 of equivalent and to the calibrated in 'bar' and 'psi'. The working range not to exceed 65% of full scale range except on DPI(s).
- For analogue gauges, have a minimum scale length of 90 mm
- In the case of PI, be located on:
  a) Compressor(s).
  b) Air receiver(s).
  c) Downstream of each pressure regulator.
  d) On each dryer.
  e) On the distribution main in plant room downstream of plant isolating valve.
  f) Upstream and downstream of each sterile filter.

- In the case of DPI, be located across, or on each filter assembly

3.2.4.5 Condensate Management System

The total condensate management system shall comply with the Malaysia Environmental Quality (sewage and industrial effluents) Regulations : 1979 3rd Schedule. [Regulation 8(1), 8(2), 8(3)] as at 31st August 97]. It shall comprise of:

a) Electronic-mechanical automatic condensate drain

b) Oil/water condensate processor

3.2.4.6 Electronic-mechanical automatic condensate drain

The device shall be of:

- The electronic-mechanical type that reliably discharge liquid condensate without air loss
- Electronic sensor without moving parts
- Top entry for pressurized liquid condensate
- Automatically self-adjusting voltage range from 24v to 230v
- Self-monitoring electronic with power / alarm and testing facility

The specification of the electronic-mechanical automatic condensate drain shall be as follows:

- 5 and 10 m3/min for compressor and filter dryer, respectively
- 60°C condensate and ambient environment
- 0.8-16 bar pressure range, operating
- Drainage volume, without air loss, not less than 0.10 liter
- Shall be retrofitted with a 5 micron Y-strainer at the inlet

The electronic-mechanical automatic condensate drain shall be installed for each of the following:

- After cooler
- Air receiver tank
- Filter(s) assembly upstream of refrigerant and breathing air dryer
- Refrigerant

Electrical timers and / or float controlled condensate drains are not permitted.

3.2.4.7 Oil / Water Condensate Separator Processor

Oil polluted liquid condensates from the auto condensate drains shall not be discharged to the environment without first being processed. The assembly shall mechanically separate the liquid condensate from the oil polluted contaminants such that only clean liquid condensate, ie, water be permitted for discharge to the environment via a suitable gully, or tundish.

The self-contain oil / water separator assembly shall consist of:

- A pressure relief chamber that separates condensate and expanding air.
- A sediment compartment, serviceable type.
- A coalescing foam chamber that separates the oil contaminant from the liquid condensate.
- An oil can to collect and accumulate excess oil contaminants from the coalescing foam chamber.
- An activated carbon absorber to purify the final trace of oil contaminant from the liquid water.
- A drainage outlet to discharge clean, environmental friendly water to the environment.

The specification for the oil / water condensate separator processor shall be as follows:

- 250 m3/hr max air flow
- 50 litre tank volume
- 5 litre oil tank
- 1" connection

3.2.4.8 Compressor / refrigerant dryer control unit

- The unit shall derive its power from a separate sub-circuit from the 'yellow phase' for each compressor / dryer.

- Have power supply for each compressor / dryer controlled by its own individual sub-circuit.

- Be designed such that no single component failure results in loss of plant output

- Be manufactured and installed in accordance with IEE and Local Statutory Bodies Regulations.

- Be provided with DUTY / STANDBY selection for each sub-assembly with means for manual override.

- Have devices provided to ensure that two (2) or more (where applicable) will not start simultaneously when power is applied.

- Have BS 5378 warning notice.

3.2.4.10Compressor / dryer starter unit

The compressor / dryer starter unit shall:

- Be manufactured and installed in accordance with IEE & TNB Regulations.

- Operate their respective sub-assembly.

- Include safety interlock as specified by the compressor / dryer manufacturer.

- Be designed such that all safety interlocks inhibit plant operation until manually reset by means of reset button.

- Contain as a minimum, an isolator interlocked with the covers, with circuits and switchgear(s) protected by BS 88 HRC fuses or suitable circuit breakers to 3S 4752 and/or BS 3871.

3.2.5 COMPRESSED AIR PIPELINE RETICULATION SYSTEM

3.2.5.1 Pipework material

- All pipes and fittings shall be locally manufactured to BS steel tubes, galvanised and comply with BS 1387: 1967 and BS 1360, Heavy Duty Class 'C'.

- All primary supports and pipe be painted with one (1) layer anti-rust paint and two (2) layer of gloss finish paint. The colour of the latter to be decided by the SO.

3.2.5.2 Compressed air control station

Shall include the minimum:

- Isolating ball-type valve
- Integral filter-regulator c/w gauge
- Cleaned air outlet, one (1) set
- Micro fog lubricator
- Lubricated air outlet, two (2) sets
- Necessary wall mounting brackets

3.2.5.3 Drip leg drain

- Be installed at low point in the compressed air system where water is likely to accumulate as per tender drawings.
- Be incorporated with isolating ball-type valve.

3.3 VEHICLE LIFTING SYSTEM

2.3.1 Scissors Lifts

- The drive contraction for the scissors lift shall be electrical hydraulic.
- Maximum lifting shall not be more than 2.5 m height with lifting and lowering time ≤ 60 seconds.
- High abrasive hydraulic oil shall be used with a maximum of up to 20 liters.
- Electrical power supply for the scissors lift shall be AC 400 or 240V ± 5% at 50 Hz.
- For controlling the lifting movement, safety mechanism like self-locking devices shall be included with the lift that release when lifting and drop into slotted spacers.
- Lift pit shall be within 20 cm to 150 cm and be depended on the travelling distance of the lift.

2.3.2 4-Post Lifts

- The drive contraction for the 4-post lift shall be electrical hydraulic.
- Maximum lifting shall not be more than 2.5 m height with lifting and lowering time ≤ 60 seconds.
- High abrasive hydraulic oil shall be used with a maximum of up to 20 liters.
- Electrical power supply for the scissors lift shall be AC 400 or 240V ± 5% at 50 Hz.
- For controlling the lifting movement, safety mechanism like self-locking devices shall be included with the lift that release when lifting and drop into slotted spacers.
- Lift pit shall be within 20 cm to 150 cm and be depended on the travelling distance of the lift.

2.3.3 Lift Installation

When doing preparatory work, product for both scissors and must be handled and stored according to manufacturer's recommendation. Site conditions must be verified to be acceptable for installation. In order to minimize installation, lift components are prefabricated offsite (or by manufacturer) and assembled/installed onsite. Surface conditions for the installation must be of suitable structural quality depending on the weight of system. All necessary installation work must be carried out by experienced and qualified technicians whereas installation instructions and guidelines shall be provided. It is necessary at all times for the equipment, labor, transport and services to have uninterrupted access for safety enhancing.

3.4 OIL INTERCEPTOR

3.4.1 SCOPE OF WORK

a) This specification covers the minimum requirements for supply and installation of the oil/water interceptors and associated equipment required for this project.

The scope of work shall include but not be limited to the following for fully functional and system completeness:-

i. One (1) unit of oil/water interceptor and all necessary accessories.

ii. One (1) unit of oil collection tank and all necessary accessories.

iii. Submission of shop drawings and as-built drawing

iv. Submission of operation and maintenance manual documentation.

v. Painting of equipments, pipe and etc

vi. Balancing, testing & commissioning

vii. Service & Maintenance during the Defects and Liability Period

3.4.2 OIL INTERCEPTOR DESIGN REQUIREMENT

a) The oil/water interceptor shall be-fabricated unit of mild steel construction and adequately protected inside and outside by protective coatings that shall be low maintenance.

b) The oil/water interceptor shall be proven design and based on filter capable of achieving 5mg/1 effluent oil residue in accordance to DIN 1999.

c) The oil/water interceptor shall incorporate a diffuser plate, a detachable bar screen, detachable filter, chequered plate galvanised covers and an automatic closure device of stainless steel construction. It shall also incorporate an integral sludge trap compartment.

d) The oil/water interceptor shall be provided with lifting lugs to facilitate handling during installation.

e) Inlet and discharge portion of the oil interceptor shall end flanged fittings.

3.4.3 ALARM AND OIL LEVEL SENSOR

a) Hydrocarbon accumulation detectors consisting of panels with visual and audible alarm connected with shielded cables to probes shall be provided for each unit of oil interceptor.

b) Enclosure for the panel shall be rated at IP 65.

c) The probe shall either be reed switch type, electrical conductivity type or equivalent method which is subjected to The Engineer's final approval.

d) The junction box shall be rated at IP 67.

e) The panel shall be placed at location which is easily visible to the operators.

f) The distance between probe and panel shall be not more than 300 meters

3.4.4 PIPEWORKS

a) General

The drawings indicated the size of pipes and the manner in which the various systems of piping are to be run. All work where shown on the drawings or specified shall be installed in a workmanlike manner to meet the structural and architectural conditions with due allowance for other services to be installed.

Main shall pitch in such a manner as to avoid air pocketing.

All piping must be so constructed that it will be free from contraction and expansion so that it will not damage other work or cause damage to itself.

Cutting of pipe and tubing shall be done by a power hacksaw, or a circular cutting machine using an abrasive wheel, or in a square and sawing vise by means of a hand hacksaw. No pipe shall be cut with a metallic wheel cutter of any description. Pipe shall have rough edges or burrs removed, so that smooth and unobstructed flow will be obtained.

b) Underground pipe laying

All underground pipes shall be laid in each trenches of minimum 750mm depth unless otherwise stated in the Drawings. The Contractor shall be responsible for excavation, backfilling and making good and trenches. It shall be assumed the Tenderers have inspected site, the proposed routes of underground pipelines and nature of the soil and have allowed for all necessary works in connection therewith. Excavation of trenches shall be straight lines and gradients required for the pipes and beds as specified. The trench should be wide enough to allow careful alignment of the pipes and adequate working space for the layers and jointers.

The bedding for the pipes shall be thoroughly compacted. The pipes shall be laid evenly on the barrel at the required level. There should be no hollows, voids or foreign material under the pipe. Where pipe jointing holes are left in the bedding, particular care must be taken to ensure complete and proper filling of the holes after pipe testing. Where pipes are to be laid on rock formation, the excavation shall be taken to 150mm below bed level and bed will then be made up to its true line and level by refilling with 150mm of consolidated material from the excavation, well rammed and watered if necessary.

Where pipes are laid under roads, driveways or vehicle parking areas, continuous concrete bed foundation using 1:2:4 concrete shall be provided. The concrete shall be well rammed or vibrated and worked under and around the pipes to provide minimum 150mm cover all round the pipes. Similar concrete bedding and encasing shall be provided for each and every change in direction of pipeline and at the joints; such encasement shall be for minimum 900mm length before and 900mm length after the change in direction. In any case, the Contractor shall provide for all necessary anchors to resist forces due to pumps, friction, change in direction, etc.

All pipe joints shall be left exposed for inspection during the pressure tests.

The trenches shall only be bottomed up immediately in advance of pipe laying but no pipes shall be laid until a distance of at least 10m along the trench has been prepared and bottomed up to receive the pipes. The trenches and joint holes shall be kept free from water until the pipes are laid, jointed and surrounded by concrete where required. No water from the trenches will be allowed to enter the new pipes and no backfilling of trenches will be allowed until the joints of the pipes have been tested and inspected.

c) Pipe Material

Item Remark	Pipe Size (mm)	Materials	Standard
Below Ground			
Drain water	100 & 200 dia	Galvanised Iron Class C	BS 1387,1990

d) Jointing For Buried Pipes

All buried pipes shall be joined by flexible mechanical and “Tyton” joints or approved equal to the approval of the relevant local authorities.

e) Steel Piping Jointing

For all pipe connections to valves, strainers and equipment, flanged or screwed joints shall be used. All screwed joints shall be made with Teflon or equal acceptable p.t.f.e thread sealing tape: hemp or similar organic substances shall not to be used.

On galvanised iron pipework all joints up to and including 65mm diameter shall be made by welding unless otherwise indicated in the Specification Drawings.

In all cases where pipes are joined to flanged equipment, the appropriate mating flanged shall be used.

f) **Flanges for Steel Pipes**

Flanges shall be of mild steel in accordance with BS 4504 Part 1. All flanged joints shall be flush and aligned, and shall be made with corrugated jointing rings, coated on both sides with recommended jointing compound. All bolts shall be hexagonal-headed steel in accordance with BS 916 complete with washers and nuts. Flanges and bolts shall be suitable for the working pressure.

g) Proprietary made fittings, which are designed and manufactured to relevant British Standard for intended use, shall be supplied and installed. Any fitting which is fabricated from cutting pipes and welding will not be accepted.

In all cases, fittings shall be of the malleable iron type, but in all cases, entirely suited to the working and test pressures of the circuit concerned.

On all changes of directions, long radius elbows and sweep or ‘pitcher’ tees shall be used. Short elbow may be used only where physical problem warrants it and permitted by the superintendent officer. Bends, offsets and other pipe fittings formed by welding together segmented pieces will be rejected. Short fill-in sections of piping less than 150mm long shall not be welded onto any pipe run.

Reduction in the diameter for through-flow pipes shall be means of reducing sockets for vertical pipes only: for horizontal piping and connections to pump suction, eccentric reducing sockets shall be used.

Unions shall be provided where necessary to permit dismantling of pipework or removal of valves and equipment. Union of the same materials as associated pipings shall be used.

