10.24.5.7  **AUXILIARY STEAM SYSTEM (optional, Only if required)**

10.24.5.7.1  **General**

An auxiliary steam system consisting of an auxiliary boiler shall be supplied together with all related equipment. All auxiliary boiler system shall be suitable for operation with natural gas. All auxiliary boiler system shall be explosion proof type according to NFPA.

10.24.5.7.2  **Auxiliary Boiler scope of supply**

The auxiliary boiler shall include the following:

- Boiler (including: Dual fuel firing System (NG and oil #2), Air Fan, Fuel Pumping System, fuel supply system, necessary piping and valves, etc.) with full automatic start-up and loading control.
- Deaerator.
- Boiler Feedwater pumps including related piping systems.
- Stack and flue gas system.
- Chemical Dosing station.
- Blow-down flash tank.
- Instrumentation and complete Control and monitoring system for all supplied equipment.
- Electrical equipment, motors.
- Interconnection wiring and cables between the various equipments assemblies provided by the Contractor.
- Daily Oil #2 tank with necessary instrumentation and control.
- Fuel Oil #2 transfer pumps (2x100%) including all necessary valves, instrumentation and accessories to be controlled automatically from the auxiliary boiler Control systems.

The auxiliary boiler shall be Approved and Certified by Israeli Institute and be in strict accordance with the requirement of SI 4280 part 1.
10.24.5.7.3 The Boiler shall include, but not limited to the following equipment:

- Boiler (including: Firing System, Air Fan, Fuel Pumping System, fuel supply system (natural gas and oil #2), necessary piping and valves, etc.) with full automatic start-up and loading control.
- Deaerator.
- Boiler Feedwater system including feedwater pumps.
- Stack.
- Chemical Dosing station.
- Blow-down flash tank.
- Control and Instrumentation.
- Electrical equipment, motors.
- Interconnection wiring, cables and piping between the various equipment provided by the Contractor.
- 2m³ daily oil #2 tank.
- Fuel Oil #2 transfer pumps (2x100%) including all necessary valves, instrumentation and accessories.
- 2 x 100% fuel oil No. 2 burner injection pumps, skid mounted including all necessary valves, instrumentation and accessories.
- Piping, piping supports, piping accessories, valves, valve actuators support steel (auxiliary steel), piping and equipment thermal insulation for all systems within the scope of supply.

10.24.5.7.4 The Auxiliary Boiler shall ensure easy and fast cold, warm and hot plant start-up. At start-up it shall provide:

- Sealing steam for steam turbine.
- Cooling steam for steam turbine (if applicable).
- Deaerator heating steam.
During plant commissioning it shall provide steam for the auxiliary piping systems, heating steam to the chemical cleaning system.

The Boiler capacity and parameters (pressure and temperature) together with the auxiliary equipment data will be selected by the main Contractor. The auxiliary Boiler will use the same fuel as the gas turbines i.e. fuel oil No. 2 and natural gas.

The entire unit shall be suitable for indoor installation in a shed structure.

10.24.5.7.5 **Auxiliary Boiler**

The Boiler shall be designed, built inspected and stamped according to:
- ASME code - section I - power boilers or EN (former TRD).
- Approved and certified by Israeli Institute and be in strict accordance with the requirement of SI 4280.

The Boiler may be of:
- either water tube type
- or fire tube (shell) type

The Auxiliary Boiler and associated equipment shall have enough turn-down ratio to ensure any required load during any possible operation case. The boiler shall be able to achieve stable, safe and reliable operation when firing natural gas and oil #2 at all operating load.

The complete auxiliary steam system shall be designed for at least minimum load of 10% of the rated steam capacity.

The Boiler shall be complete and will include all required parts and accessories, such as (but not limited to):
- Evaporator (drums included if applicable)
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Engineering Division

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- Casing (boiler body) including manholes, inspection and cleaning doors.
- Thermal insulation and lagging (asbestos materials not acceptable)
- Refractories
- Ignition system
- Oil and Gas Burner(s) including flame detector(s).
- Forced Draft (air) fan including silencer (driving motor included)
- Boiler Piping and valves (feedwater and steam shut-off valves and steam flow measurement element, F.W. check valves, feedwater-control valve, safety valves, blow-down valves, venting and drain valves, sampling valves etc.).
- Fuel oil piping system (valves included and flow measurements elements).
- Natural Gas piping system (valves included and flow measurements elements).
- Air and Flue gas ductworks (dampers included).
- Base Frame
- Stairs and Platforms
- Control and Instrumentation (sampling system included).
- 2 x 100% fuel oil No. 2 burner injection pumps, skid mounted including all necessary valves, instrumentation and accessories.
- Fuel Oil #2 transfer pumps (2x100%) including all necessary valves, instrumentation and accessories.
- 2m³ daily oil #2 tank located indoors.
- Piping, valves, control valves, supports, fittings, accessories etc.
- Gas detection system – to warn about presence of gas in the boiler area.

The complete unit should be entirely factory assembled and tested. Steam and water passages including drums shall be completely drainable.

In addition to Boiler protection requirements as specified, ASG shall include at least two level switches separated connected on drum as required in TRD 604.
10.24.5.7.6 **Burners**

- Fuel: Low NOx Burner(s) shall be designed to burn natural gas and oil #2. The burner(s) shall be designed so that changeover from oil to gas will require only withdrawal of the oil gun. Need for a mechanical change to change fuels is not acceptable. Mechanical atomizing, steam atomizing, or air atomizing shall be selected based on the boiler turndown required.

- Piping for Burners: Each burner shall be complete with all required integral piping and supports. The oil and gas piping and atomizing air or steam piping required shall include manifold headers with branch connections from the manifolds to each burner. Shutoff valves and flexible metal hose shall be provided in the branch connection to each burner. Connections shall be provided on the manifolds (if applicable) for instrumentation.

- Ignition by LPG shall be avoided. When firing oil #2 ignition shall be either by oil #2 pilot or directly by high spark ignition (HEI).

- The Maximum emissions at 3% O2 will be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Natural Gas</th>
<th>Oil #2 (back up only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>Level</td>
<td>Load range</td>
</tr>
<tr>
<td>NOx</td>
<td>[mg/dNm3]</td>
<td>200</td>
</tr>
<tr>
<td>CO</td>
<td>[mg/dNm3]</td>
<td>50</td>
</tr>
<tr>
<td>particulate</td>
<td>[mg/dNm3]</td>
<td>5</td>
</tr>
</tbody>
</table>

10.24.5.7.7 **Valves, Fittings and Connections**

The following steam generator-related components shall be provided:

- Safety valves, as required by ASME Code (or approved equivalent).
- One steam outlet isolating valve.
o One steam (outlet) pressure reduction control valve.

o One set of feedwater supply valves (including feed water control valve).

o One set of blow-off valves.

o One drum vent valve.

o Level gauges and transmitters.

o All the instrumentation.

o Sets of drain and vent connections and valve sets, as required.

10.24.5.7.8 The following valve connections shall be provided on the steam drum:

o Auxiliary steam connection, if steam atomizing oil burners are furnished.

o Continuous and intermittent blow-down.

o Chemical feed.

o Water sampling.

o Nitrogen supply.

10.24.5.7.9 Daily Oil #2 Tank

o A complete set of daily oil #2 tank shall be supplied with necessary instrumentation and controls.

o The Tank capacity shall be 2 m\(^3\) located indoor near auxiliary boiler.

o The Tank shall be made of steel with minimum wall thickness of 6 mm and shall be epoxy based painted from the inside and the outside.

o The Tank shall be hydrostatically factory tested for 24 hours with water head of 3m above the tanks height.

10.24.5.7.10 Fuel Oil #2 transfer pumps

A complete set of Fuel Oil #2 transfer pumps from oil tank farm to the auxiliary boiler (2x100%) shall be supplied, including all necessary valves, instrumentation and.

The Fuel Oil #2 transfer pumps shall allow automatic control from the auxiliary boiler Control Systems.
For additional requirements refer to Feed-water pumps par. 14.14.8, as applicable.

All pumps shall be connected and operated from the main control system and from the auxiliary boiler PLC.

The pumps shall be supplied skid mounted. The skids shall be hot dip galvanized and painted.

10.24.5.7.11 **Aux. Boiler Deaerator**

The deaerator has to preheat the inlet cold demineralized water (or condensate) and to remove the dissolved gases (especially oxygen and carbon dioxide) from the feedwater.

The deaerator capacity shall be according to the auxiliary boiler’s capacity. The deaerator pressure will be selected by the Supplier according to the acceptable Boiler Feed Water temperature.

Design, construction, inspection and stamping shall be according to:

- ASME Code - Section VIII - Division I.

The Deaerator shall be supplied with:

- Level control valve.
- Steam Pressure control valve.
- Safety valve(s).
- Various closing valves.
- Venting and Drain valves.
- Instrumentation and control.

The Deaerator shall be either "Spray tray" or "Spray" type.
10.24.5.7.12 **The Aux. Boiler Feedwater pumps**

Two (2) 100% Boiler Feedwater pumps shall be provided.

The pumps shall be of the centrifugal type, either multistage or single stage and shall be of the heavy-duty type.

Each pump shall ensure at least the following conditions:

- Supply of 1.25 times the maximum boiler capacity at the maximum operating pressure.
- Supply of the maximum boiler capacity at 1.1 times the maximum operating pressure.

Each pump shall be supplied with electrical motor drive, coupling and base plate.

Shaft seals shall be of mechanical type. Wetted parts' materials should be of either 12% chrome steel or 18-8 stainless steel.

A minimum flow re-circulation control device shall be provided for each pump.

Boiler feedwater pumps shall not use external source of cooling water.

Bearings shall be pre-lubricated at the factory and designed for a L10h life of 50,000 hours.

The pump characteristics shall include a NPSHR curve. A minimum margin of 25%, must be maintained between NPSHR and NPSHA values at all operating flows.

Lifting lugs or eyes shall be provided as required.

Casing vent and drain openings shall be provided and shall be plugged.

**Testing:**

Each pump that is purchased shall be factory tested at full rated speed over the full capacity range from minimum flows. Data shall be taken at a minimum of seven (7) points to confirm the pump characteristic,
horsepower and efficiency curves. The test shall also confirm the mechanical integrity, vibration and NPSH characteristics of the pumps.

NPSH test shall be done only on one (1) pump of each item. A test shall be performed to determine the head for the “break-away” point (initiation of cavitation, or onset of cavitation). Data shall be submitted containing test points with 3% head breakdown.

Field tests shall be done by the Purchaser at the Power Station according to Hydraulic Institute Standards or ASME PTC 8.2 to assure that the Equipment and its performance shall conform to the requirements of the Specifications and Guarantees.

Hydrostatic testing of the pumps shall be conducted at one and a half (1½) times the design pressure.

10.24.5.7.13 **Stack**
A free-standing, self-supporting stack shall be provided, at a height of approximately 6m.

The Contractor will select the stack height to not interfere with the proper operation of the unit. The stack shall be properly insulated and protected against corrosion. Stack materials shall be "CORTEN" or equivalent to reduce risk of corrosion.

An inspection opening should be provided.

10.24.5.7.14 **Chemical Dosing Station**
A suitable chemical dosing system (ammonia and phosphate) shall be provided. The Dosing system shall be completely skid mounted, outdoor design, located outside the auxiliary boiler house and will include:

- Solution tank(s) with mixer.
- Metering pumps.
- Strainers, various valves, piping and other accessories.
- Instrumentation.
- Shed for tank and pumps including 110% stainless steel dyke.

10.24.5.7.15 **Blow-Down Flash Tank**

A suitable flash tank for the Boiler Blow-down and drains shall be provided. The tank shall be designed, constructed and inspected according to ASME section VIII, Div. 1.

10.24.5.7.16 **Thermal insulation and lagging**

- Insulation shall be furnished for all hot surfaces of the equipment and for all appurtenances furnished therewith which require insulation, complete up to the termination of all equipment furnished by Contractor, including all hot air and gas ducts, safety valves, all piping, etc.
- The use of asbestos and/or insulating materials, cloth, tape, etc., containing asbestos is prohibited in the insulation work.
- The use of carcinogenic insulating materials such as category 2 or lower under the provisions of the ESA directive 97/69EC or equivalent is prohibited in the insulation work.
- The insulation material shall be biologically inert and unaffected by vermin and does not encourage the growth of fungi, molds, or bacteria.
- Insulation for various surfaces shall be of such quality and thickness to assure that the temperature of the finished outside surface, or outside surface of casings or lagging, will in no case exceed 60ºC when the surrounding air is at a temperature of 25ºC.
- Insulation thickness calculations shall be based on theoretical still air conditions and shall be at least Rock wool 100Kg/m and 120mm.
- All insulated surfaces of the steam generating unit and associated ductwork, piping, and tubes shall be metal lagged. Metal lagging shall be aluminum as applicable.
The metal lagging shall be completely waterproof with proper flashings installed so that water cannot reach the insulation. The lagging shall be designed and installed to provide for complete water runoff with no pockets where water can collect.

10.24.5.7.17 **Cleaning and painting**

Internal Cleaning:
Special attention shall be given to the proper cleaning of all internals of the auxiliary boiler. The exact method of cleaning that will be used must be approved by the Purchaser. Auxiliary boiler shall be designed to allow an internal alkali cleaning, performed by IEC. Contractor will provide a pre-operational cleaning procedure.

Exterior Cleaning and Painting shall be in accordance with manufacturer normal practice as approved by the Purchaser.

10.24.5.7.18 **Hydrostatic Test**

Valves and fittings shall be shell hydrostatically tested per ASME Power Boiler Code requirements. Valves shall also be seat-tightness tested in accordance with valve manufacturer's standard practice.

The auxiliary boiler shall be Hydrostatically shop tested. If the auxiliary boiler requires field assembly or welding of pressure parts, the auxiliary boiler shall be further hydrostatically tested by the boiler erector after completion of erection in accordance with the ASME Power Boiler Code.

10.24.5.7.19 **Control and Measurements**
The Contractor shall supply sufficient measurement for monitoring the equipment, in addition to the combustion control, automatic control, deaerator control, feedwater control and automatic start up and shut down.

The Auxiliary Steam control system should communicate with the unit's control system.

**Combustion Control**

The fuel and air flow shall be controlled, to provide the steam pressure desired throughout the load range. To assure optimum combustion efficiency, both the fuel and air flows shall be controlled according to the demand, as established by the Pressure Master Controller through the fuel control valves and the forced draft control drive, respectively.

A lead-lag feature shall be included, to maintain an excess air during load changes. The desired fuel - air ratio shall be automatically changed at the various operating loads. Manual trim of this ratio shall also be provided and shall be used by the operator, to compensate for the changes in the fuel quality.

Provisions shall be made to limit the minimum air flow, to effect smooth transfer of the fuel control valve from the light-off position to the boiler demand start-up and to limit the firing rate. The system shall be designed for individual operation on each fuel, as selected through a panel mounted switch.

The combustion control systems shall include the necessary interlocks and limit devices to insure the safety of the system as per NFPA-85 requirements.
The feedwater control shall maintain the drum level to its set point at the various loads and shall provide the necessary transient adjustments to cope with the "swing-swell" relationship.

The Contractor shall provide the feedwater pumps re-circulation control, is necessary.

**Automatic Control**

The boiler should operate automatically after manual start. Prior to start and during the operation, all the required conditions will be checked automatically and all the equipment shall be started sequentially. Failure of any operation should trip the boiler.

Boiler continuous drum level control shall be implemented by differential pressure transmitter.

**Deaerator Control**

The deaerator shall be provided with all the necessary level and pressure control and instruments.

Level control shall be implemented by differential pressure transmitter.

**Instrumentation**

See annexure B

10.24.5.7.20 **Electrical Requirements**

Electrical equipment installation and cables routing in hazardous areas, shall be classified for hazardous areas, as specified in the attached supplement 8.9.1.22 - "HAZARDOUS AREA CLASSIFICATION". For example, all electrical equipment, motors, instruments etc. within 2m around NG flanged connections shall be explosion proof type according to
Zone 2 requirements, i.e. at the burner front zone and at the NG supply skid area. Furthermore, they shall meet requirements of IEC 60079-14 Standard "Electrical installations in Explosive Gas Atmospheres".

The Contractor shall provide a BOILER LOCAL PANEL, free standing, NEMA 4X, enclosure, completely wired and pre-tested, to be mounted indoors, near the auxiliary boiler.

This panel shall have separate sections for power and control components and shall contain all the necessary motor starters, control and selector switches, control logic, local operator interface (HMI) to control, monitor and test the operation of the auxiliary boiler.

The system and all its components shall be designed for maximum reliability, availability and long life, and shall employ programmable logic Controllers (PLC) or microprocessor based equipment.

For additional electrical requirements, see Para. 10.27 of Annexure B.