APPENDIX A

REQUIREMENTS FOR PROCESS EQUIPMENT DATA SHEETS
<table>
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<tr>
<th>Process Unit</th>
<th>Data sheet requirements (where applicable)</th>
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</table>
| Fuel Gas engine      | • Type of engine  
• Applicable standards and design codes compliance, acceptable site conditions and list of manufacturers that comply with the applicable standards and design codes as well as site conditions  
• Capacity and dimensions  
• Nozzles identification table including rating, size and quantity for each nozzle  
• Fluid flow rates  
• Operating and design temperatures and pressures at inlet and outlet  
• Heat duty and physical properties at inlet and outlet conditions  
• Allowable pressure drop and allowable temperature differential  
• Maximum turn-down ratio of heater and burner considering its effect on the unit performance  
• Fuel characteristics and other working fluids:  
  - service or purpose  
  - name or designation  
  - acceptable suppliers  
  - volume required  
  - density, viscosity, impurities  
  - design life  
  - material safety data sheet  
  - hazards, safety, handling, disposal and warehousing/storage  
• Minimum efficiency  
• Limiting fluid peak temperatures  
• Limiting transfer rates or velocities  
• Heat flux density (maximum allowable)  
• Control specifications  
• Instrumentation and sensors requirements (type, power requirement, accuracy, code compliance)  
• Specific design and fabrication requirements  
• Whether air preheat system envisaged with forced draft fans and ducting is required  
• Material of construction for tubes  
• Corrosion allowances  
• Maximum allowable excess air for any type of fuel  
• Type of terminal fittings |
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<tr>
<th><strong>Absorption Chillers</strong></th>
<th><strong>Storage Tanks</strong></th>
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</table>
| - Whether coil temperature and pressure profile is required from vendor  
- Maximum allowable flue gas temperature  
- Environmental and safety aspects  
- Electrical power for start up and control systems, instrumentation and sensors  
- Firefighting requirement and telecommunications systems  | - Type (e.g. floating roof, fixed roof, double roof, spherical, etc.)  
- Purpose or service  
- Dimension and nominal capacity  
- Applicable standards and design codes compliance, acceptable site conditions and list of manufacturers that comply with the applicable standards and design codes as well as site conditions  
- Operating, maximum and design temperature and pressure  
- Fluid properties  
- Internal facilities such as air sparge, steam heater, mixers and other requirements as applicable  
- Requirements of insulation  
- Any special surface finish requirement including painting, sandblast (internal and external surfaces)  
- Stress relieving and post weld heat treating requirement  
- Instrumentation requirements  
- A simplified storage tank sketch showing all internals and nozzles and instrumentation  
- Loading and unloading rates  
- Inspection requirement  
- Firefighting requirement |
| - Type  
- Energy source and heat input requirement  
- Cooling and heating capacity  
- Dimensions, dry weight, operating weight  
- Heat rejection method and specifications of equipment and system thereof  
- Applicable standards and design codes compliance, acceptable site conditions and list of manufacturers that comply with the applicable standards and design codes as well as site conditions  
- Design Space Heating and cooling loads  
- Equipment and controls for integration with existing HVAC systems, specifications fit for design and acquisition  
- Corrosion allowances where required  |
| Heat exchangers | • Purpose or service, type of heat exchanger  
• Applicable standards and design codes compliance, site conditions applicability, list of manufacturers that comply with the applicable standards and design codes as well as site conditions  
• Temperature control system  
• Duty (normal and design)  
• Hot and cold side detail  
• Flow rates for liquid/vapor phases separately  
• Physical properties of the fluid such as specific heat, boiling temperature, viscosities, densities, thermal conductivities, etc.  
• Inlet and outlet temperature and pressure  
• Maximum allowable and normal operating pressure drop  
• Fouling resistances  
• Condensing or vaporization curve (if necessary)  
• Type of TEMA (Tubular Exchangers Manufacturers Association) design (TEMA C – General Service, TEMA B – Chemical Service, TEMA R – Refinery Service)  
• Mechanical design conditions  
• Materials and corrosion allowances  
• Limiting transfer rates and velocities where applicable  
• Restrictions on combining air fin services  
• Tube layout and arrangement  
• Baffle arrangement  
• Driver load, shaft power, number of bays, number of unit  
• Fan detail, tube arrangement, adjustable device for fan detail, induce force specification for air coolers  
• A simplified sketch showing nozzles and general configuration for kettle type exchangers, the sketch shall also include vapour space, surge volume required, high/normal/low liquid levels and instrumentation |
| --- | --- |
| Machinery (pumps, blowers, compressors and turbines etc.) | • Type  
• Purpose or service  
• Applicable standards and design codes compliance, site conditions applicability, list of manufacturers that comply with the applicable standards and design codes as well as site conditions  
• Minimum, normal and maximum flow rates required considering all modes of operations  
• Material of construction and corrosion allowances  
• Special mechanical/process features required; |
| Piping and pipeline | Operating and design temperatures and pressures at suction and discharge;  
|                     | Surge system and control requirements (noise control, speed control, mode of control requirements, etc.)  
|                     | Physical properties of the fluid at suction and discharge conditions  
|                     | Basic recommendations for spares  
|                     | Brake horsepower and shaft power  
|                     | Sealing and lubricant requirements  
|                     | Cooling (if any) basic requirements; type of cooling water and its requirements);  
|                     | Adiabatic and polytrophic efficiency, performance curve and characteristic if available  
|                     | Net Positive Suction Head  
|                     | Alternative specifications if necessary, for specific services  
|                     | Spares philosophy of machinery  
|                     | Spare part requirements  
|                     | Flushing requirements  
|                     | Speed (rpm)  
|                     | Filter and strainer size and type for auxiliary  
|                     | Number of stages of turbine, compressor and pump  
|                     | Noise limit and environmental data  
|                     | Safety devices  
|                     | Governor type for turbines and expander  
|                     | Turndown ratio for machinery  
|                     | Pipelines and piping required, their purpose and service  
|                     | Geological and geotechnical requirements for underground pipelines  
|                     | Environmental requirements  
|                     | Piping and pipeline route diagrams, including pipe dimensions, GPS coordinates  
|                     | Steady and dynamic states/hydraulic calculations (flow assurance study) and modelling  
|                     | Pigging requirements  
|                     | Depressurizing and blowdown time calculation study  
|                     | Stress analysis and thickness calculation  
|                     | Specification for insulation, painting, coating, heat tracing  
|                     | Line list, valve list, etc.  
|                     | Specification for underground and aboveground piping  
|                     | Specification for pipe racks and sleeper |
• Tie in points
• Specification for:
  - casing and casing material
  - bolts and nuts
  - gaskets
  - flanges
  - fittings
  - pig launcher and receiver trap
  - anchor flanges
  - insulating joint
  - valves
  - pipes
  - field hydrostatic test
• Preliminary Material Take Off
• Cathodic protection basis and criteria including the following:
  - Design Methodology and legislative obligations
  - Codes and best practice procedures
  - Drawing showing basic system design and configuration
  - Description of system components
  - Cathodic Protection Material take off
• Tightness Control system including the following:
  - Design Methodology and basic design
  - Description of the best practices, legislative requirements
  - System components specifications and capabilities