Description of capex item: Thin-film evaporator (Wiped film type):
A wiped film evaporator (WFE), or thin film evaporator, is a specialized piece of equipment that separates and concentrates components from a liquid mixture using evaporation. It is especially beneficial for processing heat-sensitive, viscous, or thermally degradable materials. Our need is to further refine essential oils, concentrate flavour compounds and purify edible oils.

Specific required features:

- A metal frame within which the system is housed (304 stainless steel or equivalent metal)
- A control panel from which various process parameters can be controlled
- The evaporation set up and glass peripheral, down-stream condensers, traps and collection vessels must be made from high-quality borosilicate glass.
- Temperature control for both heating and chilling must be provided through circulating heaters and chillers.
- The wiped film body and reservoir (feed tank) must include thermal jackets to allow for the evaporation and improved fluidity of more viscous fluids
- All glassware in the set-up must be vacuum safe for the vacuum levels expected during operation (coefficient of expansion of 3.3)

Specifications in detail:

Operating Principle	Thin-film evaporation and short-path distillation through a wiped-film mechanism
	Feed section
Reservoir (feed tank)	• 1 L capacity with constant pressure • Jacketed to maintain operating temperature of ambient up to and including 200 °C. • Must include feed valve and discharge valve • Must include 2 vacuum valves or more • Must be removable for cleaning purposes

Feed pump	• Pump speed must be controllable
	  ○ Resolution 0.1 rpm
	  ○ Speed: 0.1 up to and including 200 rpm or higher
	  ○ Volume delivery: up to 800 mL/ min or higher
	• Digital display is a requirement

	Evaporation section
Geared Motors of wiper system	• Power requirement: 120 W at 220V/50Hz • Speed of rotation: 0 – 300 rpm or higher

Coupling system between motors and wiper	• Magnetic coupling
	• Resistant to high temperature (200 °C)
	• Bearing material:
	  ○ Wear-resistant
	  ○ Resistant to high temperature corrosion
	• Fixed block materials: PEEK, PTFE
	• Jacket material: 316L stainless steel

Wiper/scraper rotor	• Inner frame (skeleton) material: 316L stainless steel • Wipers/scrapers material: PTFE-graphite composite with temperature resistance up to 300 °C. • Wipers must be bevelled with springs to maintain contact with the main evaporator wall. • Springs should also be of 316L stainless steel

Main evaporator body	• Must be made from borosilicate glass and consist of:
	  ○ Outer Jacket through which heating fluid can be directed
	  ○ Inner spiral condenser through which cooling fluid are directed for 1st stage of condensation
	  ○ Effective evaporation area: 0.05 m^2 or greater

	○ Built-in condensing area: 0.1 m^2 or greater ○ Design temperature：350 °C for working temperature of 300 °C. ○ Design pressure: 0.001 Pa to be vacuum resistant
Receptacles from main evaporator (round flask)	• 2 × Spherical flasks • High borosilicate glass • Capacity of 1 L or higher
Secondary (external) condenser	• Serpentine condenser (internal coil) • High borosilicate glass • Temperature control by circulating refrigerated bath
Receptacle from secondary condenser (round flask)	• Spherical flask • High borosilicate glass • Capacity of 1 L or higher
Glass cold trap (for protection of vacuum oil)	• Double jacketed cold hydrazine type • Capacity of 2 L or higher • Dust cover must be included
Receptacle from glass cold trap (round flask)	• Spherical flask • High borosilicate glass • Capacity of 1 L or higher
<u>Peripheral devices and accessories</u>	
Laboratory jacks/lifting systems for support	• 2 sets: ○ Cork rings for receptacles (round flasks) ○ Countertop laboratory lifting jacks
<u>Temperature control systems</u>	
Heating system	• 2 × High temperature circulators • Heating range from room temperature up to and including 300 °C or higher: ○ 6 stainless steel hoses ○ heat insulation sleeve(s) • Power supply: 220V/50HZ • Tank capacity: 5 L • Circulation pump flow: 15 L/min or faster
Low temperature circulating system (for condensers)	• Low temperature circulator • Cooling range from room temperature down to and including -20 °C or lower: ○ 2 stainless steel hoses ○ insulation sleeve(s) • Power supply: 220V/50HZ • Tank capacity: 5 L • Circulation pump flow: 35 L/min or faster
Built-in thermostat system	• high temperature cooling circulation thermostat, to achieve -20 °C up to and including 100 °C.

	degrees continuous heating and cooling: ○ 2 stainless steel hoses ○ insulation sleeve(s) ○ Heating power: 1.2kw ○ Cooling power: 0.6KW • Power supply: 220V/50HZ • Tank capacity: 5 L • Circulation pump flow: 20 L/min or faster
Vacuum system	
Two-stage rotary vane vacuum pumps	• Power supply: 220/50Hz • Pumping speed: 6L/S • Limit pressure: 0.067Pa • Speed: 1400rpm • Oil consumption: 1.5L • Accessories: ○ SUS304 stainless steel bellows ○ 1 × SUS304 anti-oil high vacuum valve ○ 1 × oil separator (demister)
Gaskets (to maintain vacuum between glass and stainless steel connectors)	• Material: stainless steel 304 + fluorine rubber O-ring
Metal pipe fittings	• Material: SUS304 • Include valves for vacuum control • Include gaskets for interface with glass.
Instrument control console and frame	
Control console	• Contained in protective box • Include control buttons and displays for all controlled functions, e.g. vacuum, temperature. • Robust connectors between console and control points, preferably aviation plug and socket systems
Frame (to be assembled)	• Metal frame: Stainless steel (304) or similar corrosive resistant, rigid metal, e.g. aluminium • Solid floor with connections for metal frame • Height adjustable, swivel casters for easy movement of evaporator. (at least two must include brakes) • Brackets for frame assembly
Accessories and consumables that must be included	
Fixtures	• Clamps, lifts and cushioning devices for glassware and traps to secure them to the frame and for support, respectively. • Brackets for frame and positioning of various parts of the system

Plumbing	• All tubing required for fluid lines from temperature controlling devices to the system must be included.
Vacuum	• Gaskets, seals and sealing lubricants must be included • Clips and clamps for all connections • Tubing from vacuum pump to system must be included.
Manuals	• English language instruction manual and related documents • Digital copies preferred, but not a requirement
Spares and tools	• A set of tools for assembly and disassembly of the frame and equipment • Spare screws, nuts and clamps

Warranty and service:

- At least a 1-year warranty on parts and labour, glassware may be excluded, but must be delivered without flaws or breakage.
- Commissioning by service provider and training included in pricing estimate
- Separate quotation on routine service costs, including wear-prone spare parts.