

## Portable Tube Leak Testing Devices for Heat Exchanger

### 1. Scope of Supply

capable of performing both **pressure decay** and **vacuum decay** testing, including:

- Complete testing kit with dual capability (pressure + vacuum)
- All necessary support tube assemblies and seal/washer sets
- Consumables for initial operation (see Section 7 for quantities)
- Protective carrying case(s)
- Digital pressure/vacuum gauges (analog gauges DO NOT meet requirements)
- Pressure regulator with over-pressure protection
- Online technical training
- Comprehensive warranty
- Complete documentation package

**Application:** Leak testing of **fin-fan air-cooled heat exchanger tubes** and **shell-and-tube heat exchanger tubes**

### 2. APPLICATION DATA

#### 2.1 Heat Exchanger Fleet

Parameter	Copper Tubes	Carbon Steel
Quantity	396 tubes	216 tubes
OD	11.7 mm	16.8 mm
Wall Thickness	0.35 mm (thin-wall)	1.5 mm
Tube ID	~11.0 mm	~13.8 mm
Length	Up to 11 m	Up to 6.6 m

**CRITICAL:** Thin-walled copper (0.35 mm) requires special safety considerations.

#### 2.2 Site Conditions

- **Site Plant Air:** 6-7 bar (87-102 PSI) continuous supply

### 3. GENERAL TECHNICAL REQUIREMENTS

The proposed tube leak testing system shall meet or exceed the following mandatory requirements:

#### 3.1 Testing Capability (Both Methods Required)

The system **MUST** provide both testing methods:

##### 1. Pressure Decay Testing:

- Two (2) pressure test guns (one at each tube end)
- Adjustable test pressure: **40-130 PSI (2.7-8.9 bar)** with precision regulation
- **MANDATORY:** Pressure regulator adjustable to **40-60 PSI (2.7-4.1 bar)** for thin-walled copper tubes
- Digital pressure gauge (analog gauges DO NOT meet sensitivity requirement - see Section 3.5)

##### 2. Vacuum Decay Testing:

- One (1) vacuum gun
- One (1) T-handle plugging tool
- Vacuum capability: Up to **-0.9 bar gauge (90% vacuum)**
- Digital vacuum gauge (see Section 3.5)



**Rationale:** Copper tubes require vacuum testing OR low-pressure testing with regulator. Carbon steel tubes with plug sheet headers require pressure testing. Both capabilities are essential.

### 3.2 Tube Compatibility

The system MUST accommodate the following tube internal diameter range with appropriate seal and support tube assemblies:

- **Minimum ID:** 11.0 mm (copper tubes)
- **Maximum ID:** 13.8 mm (carbon steel tubes)
- **Extended range capability:** System should be expandable to test larger tubes (up to 32mm ID) with additional seal sets

#### Vendor shall provide:

- Complete listing of compatible tube ID ranges for all included seal sets
- Seal set part numbers for our specific tube sizes
- Availability of additional seal sizes for future requirements

### 3.3 Extended Support Tubes for Air-Cooled Heat Exchangers

- Extended support tube assemblies (minimum 1 ft / 30.5 cm length extension)
- Backup washer sets specifically designed for ACHE/fin-fan applications
- Quantity: Sufficient for both pressure test guns AND vacuum gun

### 3.4 Over-Pressure Protection

The pressure testing system MUST include mechanical over-pressure protection to prevent damage to thin-walled tubes (0.35mm copper):

#### Required Features:

1. **Adjustable pressure regulator:**
  - Settable range: 40-60 PSI (2.7-4.1 bar) for copper tubes
  - Settable range: 60-130 PSI (4.1-8.9 bar) for carbon steel tubes
  - Pressure relief valve or mechanical stop
2. **Operator Protection:**
  - Over-pressure protection CANNOT rely solely on "operator judgment"
  - Must be mechanical/automatic protection
  - Relief valve preferred
3. **Documentation:**
  - Vendor must provide written procedure for setting safe pressure limits
  - Procedure must be specific to 0.35mm wall copper tubes

### 3.5 Digital Gauge Requirement

#### Specification:

- **Digital display mandatory** (analog gauges NOT acceptable)
- **Minimum resolution:** 0.05 bar (or finer)
- **Calibration:** Valid calibration certificate required
- **Demonstrated detection capability:** Vendor shall confirm gauge system can reliably detect  $\leq 0.1$  bar pressure change over 5-minute period in 11-meter tube
- Gauge accuracy alone is insufficient; vendor must demonstrate detection capability

### 3.6 Leak Sensitivity (MANDATORY)

The system shall reliably detect:

**Pressure Decay:**  $\leq 0.1$  bar pressure drop over 5-minute hold period

**Vacuum Decay:**  $\leq 0.1$  bar vacuum loss over 5-minute hold period



**In tubes up to: 11 meters length**

This performance SHALL be achieved using:

- Digital gauges (see Section 3.5)
- Properly sized seal and washer sets
- System operated per manufacturer's procedures

**Vendor shall provide:**

- Confirmation that digital gauge system can detect  $\leq 0.1$  bar decay
- Typical test time for 11-meter tubes (pressurization + stabilization + hold time)
- Any limitations or conditions affecting sensitivity

### **3.7 Tube Length Capability (MANDATORY)**

System must effectively test tubes up to **11 meters (36 feet) length**.

**Vendor shall specify:**

- Maximum recommended tube length for reliable testing
- Typical test cycle time for 11-meter tubes:
  - Pressurization/evacuation time
  - Stabilization time
  - Minimum hold time for  $\leq 0.1$  bar sensitivity
- Any special considerations for long tube testing

### **3.8 Construction and Ergonomics**

- **Material:** Lightweight, durable construction (aluminum preferred)
- **Weight:** Each test gun  $\leq 2.5$  kg (5.5 lbs) for operator comfort
- **Grip:** Ergonomic, non-slip grip suitable for use in confined spaces
- **Finish:** Corrosion-resistant coating or finish
- **Carrying Case:** Impact-resistant protective case(s) with foam inserts

### **3.9 Compressed Air Supply Compatibility (MANDATORY)**

System shall operate on SEPCO's existing plant air supply:

**Plant Air Specifications:**

- **Pressure:** 40-130 PSI (2.7-8.9 bar)
- **Availability:** Continuous
- **Quality:** Standard industrial compressed air (filtered, dried)

**Vendor shall specify:**

- Required air consumption rate (CFM or L/min) for each test gun
- Minimum CFM for reliable operation
- Any air quality requirements (filtration, dew point, etc.)

### **3.10 Standards & Testing Methods**

**ASME Section V, Article 10:**

- Equipment shall be suitable for conducting tube leak tests in accordance with ASME Section V, Article 10 (Leak Testing Methods)
- Vendor shall confirm suitability and provide recommended test procedures
- **Note:** ASME Section V specifies test methods and acceptance criteria; it does not certify testing equipment

### **3.11 Safety for Thin-Walled Tubes**

The vendor **MUST** provide formal documentation proving the following:

1. **Safe Pressure Limit:**



- The maximum safe test pressure for 0.35 mm wall thickness copper tubes.
  - SEPCO expects this limit not to exceed 60 PSI unless justified by OEM technical evidence.
  - Documentation required: OEM calculation, test report, or field application data.
- 2. Over-Pressure Protection:**
- An adjustable pressure regulator is mandatory.
  - A mechanical pressure limiting device (relief valve or adjustable stop) is required.
  - Protection cannot rely solely on operator judgment.
  - A regulator specification sheet is required.
- 3. Proof of Suitability:**
- An OEM declaration, certified test report, or published case study.
  - Confirmation that testing 0.35 mm copper tubes will not cause deformation, damage, or collapse.
  - **"Confirmed" or "Yes" responses without documentation are not acceptable.**

**Application Note:** Our copper tubes are mechanically expanded into the tubesheet. Vendor literature states this configuration allows safe pressure testing because "expanding forces from seals are absorbed by tubesheet backup."

#### 4. Seal Set & CONSUMABLES

##### 4.1 Seal Material (MANDATORY)

- **Primary Material:** Neoprene (standard)
- The vendor shall specify:
  - Exact material specification (Neoprene type/grade)
  - Chemical compatibility (tubes may have been chemically cleaned)
  - Temperature range
  - Available alternative materials (Buna-N, Silicone, Viton) and their applications

##### 4.2 Seal and Washer Set Configuration

Each seal set shall include:

- **Seals:** Quantity per manufacturer's standard (typically 2-4 seals)
- **Washers:** Zinc-plated carbon steel or equivalent (typically 4 washers)
- **Packaging:** Clearly labeled with tube ID range and part number

##### 4.3 Seal Lifecycle & Initial Spares

The vendor shall provide the following based on the application context (mixed tube condition, periodic maintenance, trained operators):

1. **Lifecycle Estimate:**
  - Expected number of tubes tested per seal set under specified conditions.
  - Factors affecting lifecycle (tube condition, operator skill, test pressure, etc.).
2. **Spares Recommendation for Initial Purchase:**
  - Based on the total fleet of 612 tubes (396 copper + 216 carbon steel).
  - Assuming a testing campaign of 10-20% of the fleet per outage.
  - The vendor's official recommendation for quantities of each seal set part number.

**IMPORTANT:** The vendor shall quote initial spares separately as optional items.

##### 4.4 Seal Set Coverage Matrix (MANDATORY)



Vendor shall provide completed table:

SEPCO Tube Type	OD (mm)	ID (mm)	Seal Set Part Number	Quantity Included in Base Kit	Recommended Initial Spares Qty
Copper (fin-fan)	11.7	~11.0	[Vendor to specify]	[Vendor to specify]	[Vendor to specify]
Carbon Steel	16.8	~13.8	[Vendor to specify]	[Vendor to specify]	[Vendor to specify]

## 5. Required Deliverables

### 1. Complete Testing Kit:

- One (1) Vacuum Tube Leak Test Gun.
- Two (2) Pressure Test Guns (for pressure decay testing).
- One (1) T-handle plugging tool.
- Comprehensive seal and washer sets covering the specified tube ID range:
  - Minimum six (6) sets for smaller tube ranges (approx. 7.1 to 17.5 mm ID).
  - Minimum two (2) sets for larger tube ranges (approx. 16.2 to 36.8 mm ID).
- Two (2) support tube sets.
- One (1) protective toolbox/carrying case.

### 2. Documentation:

- User and maintenance manual in English.
- Calibration certificate (where applicable).

## 6. TRAINING

### 6.1 Online Training

**Format:** Video conference (MS Teams or Zoom)

**Duration:** Minimum 1 day (6-8 hours)

**Participants:** Up to 10 SEPCO personnel

**Language:** English

## 7. WARRANTY & SUPPORT

### 7.1 Warranty (Minimum Requirements)

- **Duration:** Minimum 12 months from delivery to site
- **Coverage:** Material and workmanship defects
- **Vendor shall specify:** Exact terms, exclusions, claim procedure, shipping costs

### 7.2 After-Sales Support

- Technical support contact information
- Spare parts availability and lead time
- Future support capability (equipment lifecycle)

## 8. Vendor Instructions

Vendors shall provide the following in their quotation:

- Compliance statement against each specification.
- Typical test time for tubes up to 11 m length.
- Brochures or datasheets of the offered model.
- References from at least two (2) clients in similar applications.