# Compressed Air Leak Quantification and Reporting SOP

## 1.0 Maintenance Objective & Frequency

The objective of this procedure is to systematically locate, quantify, and report all compressed air leaks in the facility's pneumatic distribution system. By measuring the ultrasonic decibel level and converting it to a volumetric flow rate (CFM or L/s), the maintenance team can calculate the annual energy cost of each leak and prioritize repairs based on return on investment. This procedure is performed quarterly or whenever a significant increase in compressor runtime is observed without a corresponding increase in production demand.

## 2.0 Lockout/Tagout (LOTO) & Safety

- Hearing Protection: Wear earplugs or earmuffs rated for at least 25 dB NRR when using ultrasonic detection equipment in noisy environments.
- Eye Protection: Safety glasses with side shields are mandatory when working near pressurized lines or fittings.
- Electrical Isolation: No electrical LOTO is required for this inspection procedure. However, ensure the ultrasonic detector is fully charged and used in accordance with manufacturer guidelines.
- Pneumatic Isolation: Do not isolate the compressed air system during the survey. The system must remain pressurized to locate active leaks. Exercise caution near high-pressure lines (typically 80-120 psi).
- Physical Hazards: Be aware of overhead piping, trip hazards from hoses, and moving equipment in the production area. Use a safety vest in high-traffic zones.

## 3.0 Required Tools, Parts & Lubricants

- Ultrasonic Leak Detector (e.g., UE Systems Ultraprobe 15000 or equivalent) with rubber focusing probe and sensitivity adjustment.
- Calibrated sound level meter (optional, for verification if ultrasonic detector does not provide dB readout).
- Digital camera or smartphone for photographing each leak location.
- Leak tagging kit: weatherproof tags (e.g., Tyvek) with wire ties, permanent marker.
- Notebook or tablet with pre-formatted leak survey spreadsheet (columns: Tag ID, Location, Description, dB Level, Estimated CFM, Estimated Cost/Year, Priority).
- Pocket calculator or smartphone app for CFM-to-cost conversion.
- Personal protective equipment (PPE): safety glasses, hearing protection, safety vest, steel-toed boots.
- Compressed air system data: current compressor power rating (kW), average load/unload cycle, and local electricity rate ($/kWh).

## 4.0 Step-by-Step Maintenance Procedure

1. Obtain the facility's compressed air system baseline data: compressor nameplate power (kW), average annual runtime hours, and the local electricity rate in $/kWh. Record this on the leak survey spreadsheet header.

2. Power on the ultrasonic leak detector and allow it to self-calibrate per manufacturer instructions. Attach the rubber focusing probe to narrow the detection cone.

3. Set the detector sensitivity to a mid-range level (e.g., 50 on a 0-100 scale). Walk the entire compressed air distribution system systematically, starting at the compressor discharge and following all branch lines to end-use points.

4. When a potential leak is heard (characteristic hissing or turbulent flow sound), slowly reduce the sensitivity until the reading stabilizes. Record the peak ultrasonic dB level at a distance of 1 inch from the leak source.

5. Visually confirm the leak location. If the leak is at a fitting, valve, or joint, note the type and size of the component. If the leak is in a pipe or hose, measure the approximate hole diameter using a wire gauge or estimate based on sound profile.

6. Assign a unique tag ID to each leak (e.g., L-001, L-002). Affix a weatherproof tag with the ID and date to the pipe or component near the leak. Photograph the leak with the tag visible.

7. Estimate the volumetric flow rate (CFM) of the leak using the manufacturer's conversion chart for the ultrasonic detector, or use the standard approximation: for a sharp-edged orifice at 100 psi, CFM = 0.0005 * (hole diameter in inches)^2 * 1000. For example, a 1/8-inch hole yields approximately 6.5 CFM.

8. Calculate the annual energy cost of each leak using the formula: Annual Cost = (CFM * 0.746 * Annual Hours * $/kWh) / (Motor Efficiency * 4.2). Assume motor efficiency = 0.85 if unknown. For example, a 6.5 CFM leak running 8000 hours/year at $0.12/kWh costs approximately $1,300/year.

9. Assign a priority level to each leak based on cost: Priority 1 (Critical) = >$1,000/year, Priority 2 (High) = $500-$1,000/year, Priority 3 (Medium) = $100-$500/year, Priority 4 (Low) = <$100/year.

10. Enter all data into the leak survey spreadsheet: Tag ID, Location, Description, dB Level, Estimated CFM, Estimated Cost/Year, and Priority. Sort the list by Priority (highest cost first).

11. Generate a formal leak survey report that includes: executive summary of total estimated CFM loss and annual cost, sorted leak list, photographs of top 10 leaks, and recommended repair actions (e.g., tighten fitting, replace seal, cut and replace hose section).

12. Upload the completed report and spreadsheet to the CMMS (ServiceGrid) as a work order attachment. Create individual repair work orders for each Priority 1 and 2 leak, referencing the tag ID and location.

## 5.0 Verification & Return to Service

1. After all Priority 1 and 2 leaks have been repaired, perform a follow-up ultrasonic scan of each repaired location to confirm zero dB reading (no leak).

2. Monitor the compressor load/unload cycle for one full production shift. Compare the average runtime percentage to the baseline recorded before the survey. A reduction of 10-20% in compressor runtime is typical after addressing major leaks.

3. Update the leak survey spreadsheet with actual repair costs and post-repair CFM savings. Close the repair work orders in ServiceGrid with completion notes and photos.

4. Schedule the next full facility leak survey on the quarterly PM calendar in ServiceGrid. Set a reminder 2 weeks before the due date to ensure the ultrasonic detector is charged and calibrated.

5. Present the leak survey report and savings summary at the next maintenance review meeting. Highlight the ROI of the repair effort to justify continued investment in leak detection equipment and training.

**Regulatory Disclaimer:** This document is a generic maintenance template provided for educational and informational purposes only. It does not constitute professional engineering or reliability advice. The end-user assumes all liability for validating all step sequences, torque specs, and LOTO protocols against specific machinery OEM manuals before deployment to a live production floor.