# Using RAE Systems Colorimetric Gas Detection Tubes and Pumps


Operation of RAE Tubes and Pumps

# Important Cautions When Using Tubes

- ***Failure to wear protective equipment may lead to cuts and other severe injuries to eyes and hands***

***Wear safety glasses and gloves when opening or handling tubes with sharp edges***

- ***Always test the pump for leaks immediately before using it for a series of measurements***

***Failure to test the pump for leakage may lead to dangerously inaccurate readings***

# Important Cautions When Using Tubes

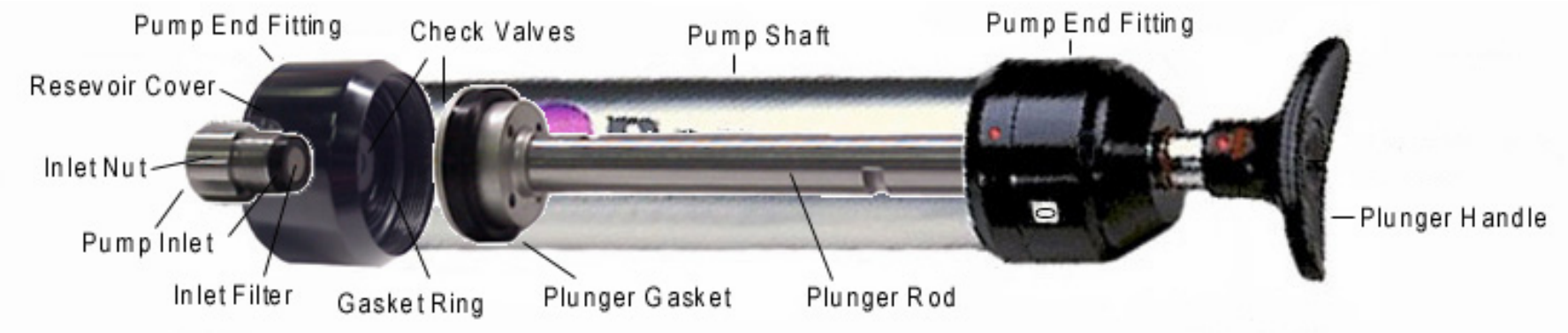
- ***Avoid contact with tube contents in case of accidental breakage***

***Exposure to tube contents can result in significant health hazards***

- ***Dispose of spent tubes according to local regulations***

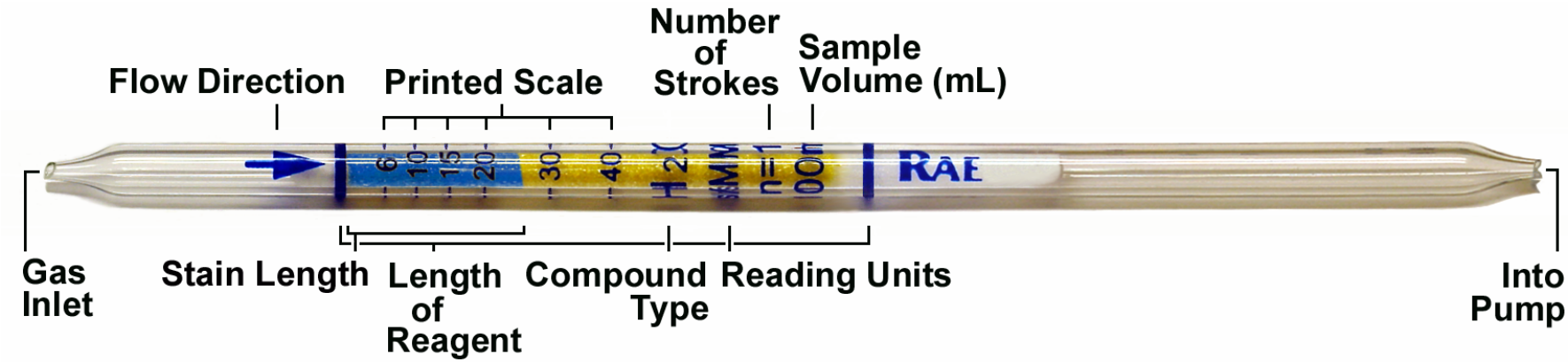
***Review information listed in the Gas Detection Tube Data Sheet to identify materials that may require special disposal procedures.***

# The LP-1200 piston-type hand-pump description




- ***Draws fixed volume of gas, either 50 or 100 mL***
- ***Vacuum seal formed by a greased plunger gasket***
- ***Tapered inlet accommodates wide range of tubes***
- ***Inlet filter protects the shaft from particulates***
- ***Handle houses an end-of-flow indicator***
- ***Built-in counter keeps track of the number of strokes***

# RAE Colorimetric Tube Description and Packaging




- ***Each box contains 10 tubes***
- ***Instructions on back of box***
- ***Arrow indicates direction of insertion and airflow***
- ***Concentration scale and gas type printed on tube***
- ***Number of strokes, total sample volume and units of measure also printed on tube***

# Tube Data Sheet Description

- ***Each box packaged with a Tube Data Sheet that gives detailed information on tube performance***
- ***Partial data sheet sample:***

**Gas Detection Tube Data Sheet**
**Hydrogen Sulfide $H_2S$ No. 103-18**

Part No.: 10-103-18-4M

| | Extended Range | Standard Range | Extended Range |
|---|---|---|---|
| Range (ppmv) | 12.5 - 125 | 25 - 250 | 50 - 500 |
| No. of Pump Strokes | 2 | 1 | 0.5 |
| Sample Volume (mL) | 200 | 100 | 50 |
| Sample Time (min) | 2 x 1 | 1 | 1 |
| Correction Factor (CF) | 0.5 | 1 | 2 |

# Testing the Hand-Pump for Leaks

- ***Insert unopened tube in hand-pump inlet***
- ***Pull one-full stroke on plunger***
- ***Wait two-minutes***
- ***While holding the pump and plunger, rotate the plunger to release***
- ***Allow the plunger to be drawn gently back into the pump shaft***
- ***The plunger should return to within three millimeters of its original position***

# Measurement Procedure

- ***Step One:***

***Break both ends of a new detection tube using the tip breaker on the side of the pump***

- ***Step Two:***
  - ***Insert the tube, arrow towards the pump***

# Measurement Procedure

- ***Step Three:***
  - ***Select the sample volume desired and align the red dot on the plunger with the red dot on the pump shaft***

# Measurement Procedure

- ***Step Four:***
  - ***Pull the handle sharply until it locks (50 or 100 mL)***
  - ***Wait for the sampling time indicated on the data sheet to allow the air to be drawn through the tube***

# Measurement Procedure

- ***Step Five:***
  - ***Flow is complete when the end-of-flow indicator returns to its full brightness.***
  - ***For additional strokes go to step six, otherwise read the tube.***

***End-of-flow indicator***

# Measurement Procedure

- ***Step Six:***
  - ***For additional pump strokes, rotate the handle ¼ turn.***

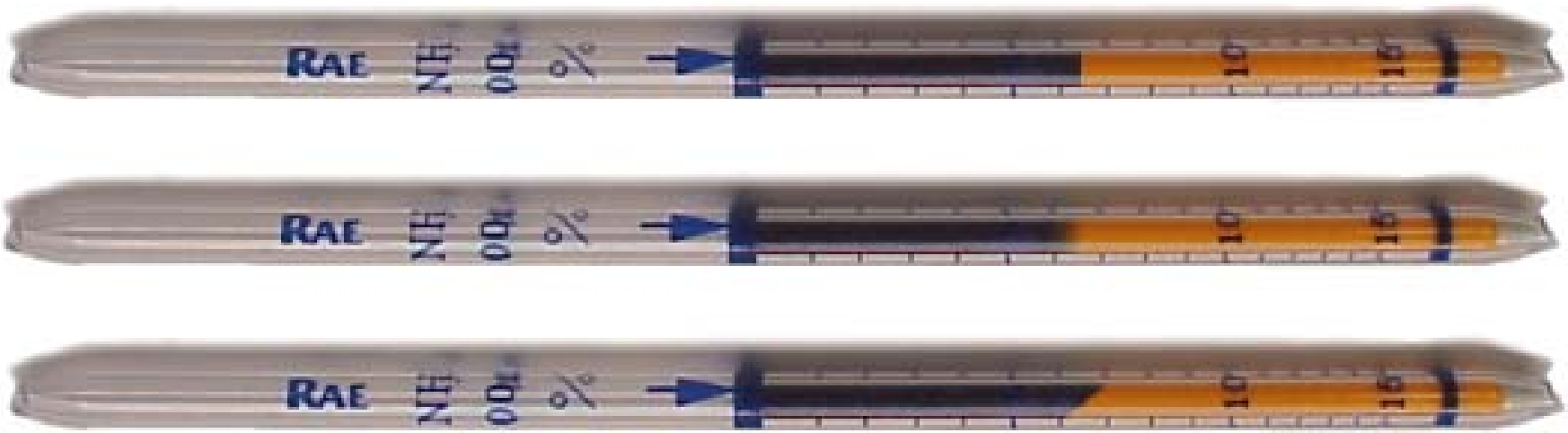
  - ***Push the plunger in without removing the tube.***
  - ***Then repeat Step 4.***

# Measurement Procedure

- ***Step Seven:***
  - ***Empty broken glass bits from tube-tip reservoir as often as is necessary***

# Reading Tubes

- ***The reading is the furthest point along the color change***
- ***If the leading edge is diagonal or diffuse, use the average of the minimum and maximum values***
- ***The three tubes shown below are all read as 6.5%***



# Reading Tubes

- ***Read tube immediately after gas sampling, as colors may change, fade, or disperse with time***
- ***If a non-standard number of pump strokes was used for sampling, multiply the reading by the correction factor given on the Tube Data Sheet***
- ***If humidity and temperature corrections are necessary as indicated on the Data Sheets, multiply the observed readings by the given correction factor(s) (CF) to obtain the true concentration***

# Sampling Volumes and Ranges

- ***Standard Sampling Volume and Ranges***
  - ***Standard stroke requirements are printed on each tube***
  - ***Gas concentrations can be measured by the scale printed on the tube***
- ***Extended Sampling Volumes and Ranges***
  - ***Varying the number of strokes (volume) allows measurement of lower and higher concentrations than printed***
  - ***Varying the stroke means that the printed scale reading must be multiplied by a correction factor (CF)***

# Cross-Sensitivity Cautions

- ***Colorimetric tubes are, by nature, selective;***
- ***However, some compounds interfere with certain measurements***

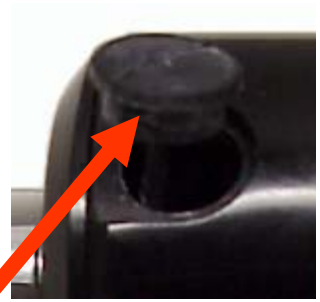
– ***Each Tube Data Sheet lists possible interfering compounds, but others may also exist***

– ***Interfering compounds can increase or decrease the reading***

– ***Be aware of potential interferences!***

# Maintenance of the LP-1200 Piston Hand Pump

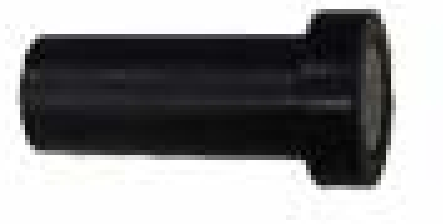
- ***Tube Tip Reservoir***
  - ***Remove the tube tip reservoir cover as needed to empty the broken glass reservoir that is in the pump end fitting***



***Tube-tip reservoir cover***

# Maintenance of the LP-1200 Piston Hand Pump

- ***Pump Inlet and Filter***
  - ***The rubber pump inlet can become worn with use and result in leaks***
  - ***Unscrew pump inlet nut and replace the rubber inlet***
  - ***If the inlet is not replaced, inspect the inlet filter and replace or clean the filter as necessary***



# Maintenance of the LP-1200 Piston Hand Pump

- ***Plunger gasket may leak if worn or not well lubricated***
  - ***To replace gasket, unscrew pump end fitting on the handle side, and pull plunger out of the pump shaft***
  - ***After replacing gasket, carefully push plunger back into the shaft***
  - ***Use a fine screwdriver or tweezers to help ease the gasket into the shaft***
  - ***Lubricate inside of shaft with vacuum grease to ensure a good seal***
  - ***Caution: Do not over tighten the plunger gasket as it could cause a sudden loss of vacuum***

# Maintenance of the LP-1200 Piston Hand Pump

- ***Inlet Valve***
  - ***Inlet check-valve may cause leaks if worn or not lubricated***
  - ***Unscrew the end-fitting on the inlet side, and pull out the disk-shaped rubber-inlet check-valve***
  - ***Replace as necessary, adding a light coat of grease around the hole***

# Maintenance of the LP-1200 Piston Hand Pump

- ***Outlet Valve***
  - ***Replace outlet check-valve gasket if there is resistance on the return stroke***
  - ***Using the special tool or needle-nose pliers, unscrew the plunger tip from the plunger rod***
  - ***Replace O-ring and check-valve gasket as necessary, and reassemble***
  - ***Inspect gasket-ring in the inlet end-fitting, and replace if damaged before screwing the end-fitting back on***