

R07130

2m Rubens' Tube

NFU 541



Purpose

The Rubens' Tube is an exciting and very visual way to demonstrate the concept of a standing wave. By making measurements it is also possible to calculate the speed of sound.

Specification

Length	2m
Speaker	20W, 8 Ω
Gas supply	Natural gas or Propane (40 millibar max)

Apparatus required

Power signal generator (e.g. G85793)
Tubing for gas supply
Hoffman clip (for fine control, optional)

Safety



Warning! The Rubens' Tube is for demonstration by teachers and technicians only. A full risk assessment must be completed before use.



- The Rubens' Tube is a demonstration item only and **must not** be used by pupils
- The tube will become very hot during operation. Avoid touching and leave to cool for at least 30 minutes after use before moving
- To avoid damaging the Rubens' Tube by over heating, do not operate for more than 15 minutes at a time

It is recommended that the Rubens' tube is thoroughly inspected at least annually. Visually check the tube and end caps for signs of damage. Check that the end caps are held securely and that the sealant is undamaged. Check the apparatus for air leaks. Using a strip of electrical insulation tape cover all the jets along the entire length of the Rubens tube.

Smooth the tape down to ensure the tape adheres fully. Attach a length of Bunsen tubing to the gas inlet. Blow down the tube gently until you feel resistance. If any air is escaping it may be possible to hear this by listening closely to each end cap.

Alternatively you can perform a leak test on the complete tube assembly. This test is very rigorous and will detect even a small leak:

1. Using a strip of electrical insulation tape cover all the jets along the entire length of the Rubens tube. Smooth the tape down to ensure the tape adheres fully.
2. Ensure that the tube is at ambient temperature before starting the leak test.
3. Attach an 8mm ID Bunsen burner tube to the gas inlet
4. Using a "Y" or "T" connector, attach a water manometer capable of showing a 16 inch pressure difference.
5. Pressurise the Rubens tube with 40 millibar (16 inches of water) and close off the inlet hose. This can be achieved by blowing gently down the tube to apply pressure and then folding the tube and securing with a clip.
6. Monitor the pressure using the manometer for 3 minutes. No decrease in pressure should be observed.

If you are at all unsure of how to operate the equipment safely it is highly recommended that you read the excellent CLEAPSS® Secondary Science Guidance Leaflet PS85B.

Operation

Place the Rubens' tube on the lab bench in a stable position **well away from any flammable material**. Connect the gas inlet on the tube to a laboratory gas tap using suitable rubber tubing intended for this purpose.

The Rubens' Tube loud speaker must be driven using a power signal generator such as the Philip Harris Power Signal Generator. Connect the high power (low impedance) output to the 4mm sockets on the end of the tube. Set the frequency to 400Hz, waveform to Sine wave, the amplitude to minimum and switch on the signal generator.

Turn the gas tap on fully and wait for 20 seconds for all the air to be purged from the tube. Reduce the gas supply to approximately 50%.

Starting at the gas inlet end, light the gas emerging from the holes. The flames should spread down the tube automatically. If any of the holes do not light use a splint to light them. **Ensure that all the holes are lit before proceeding.**

Adjust the gas pressure until the flames are a consistent height without flickering (a Hoffman clip can be used on the gas pipe to give fine control if necessary).

Increase the amplitude of the signal generator gradually and the flame height will begin to vary. Adjust the frequency until resonance occurs. The flames should now show a sinusoidal wave shape. If any of the flames go out, immediately reduce the amplitude to zero, increase the gas pressure slightly and re-light any unlit holes. Make fine adjustments to the gas pressure, amplitude and frequency to obtain the best effect.

Resonance will occur at fixed frequency multiples. Try varying the frequency to find the next point of resonance. Can the students predict the next frequency?

Playing music through the Rubens' tube can create some impressive effects. Choose a track with a strong bass line and sustained notes for the best results. An Audio lead is included to allow the connection of any device with a headphone output to the power signal generator 4mm amplifier input.

After Use:

Reduce the amplitude to zero and turn off the gas supply. Wait until all the flames are extinguished before switching off the signal generator. **Do not touch the tube as it will be very hot! Leave the tube to cool for at least 30 minutes before attempting to move it.**

Warranty, repairs and spare parts

The Rubens' Tube is guaranteed for a period of one year from the date of delivery to the customer. This warranty does not apply to defects resulting from the action of a user such as misuse, improper wiring, any operations outside of its specification, improper maintenance or repair, or unauthorized modification.

Our liability is limited to repair or replacement of the product. Any failure during the warranty period should be referred to Customer Services.

In the event of a fault, the Rubens' Tube should be referred to the Philip Harris recommended repair agent.

Please contact Customer Services or techsupport@philipharris.co.uk for advice

Instructions for authorized service technicians

Please refer to the detailed service procedures, safe servicing and continued safety – contact techsupport@philipharris.co.uk for advice.

Please refer to product specific risks that may affect service personnel, the protective measures and verification of the safe state after repair.

Supplier details

Philip Harris Education, 2 Gregory Street, Hyde, Cheshire SK14 4RH

Orders and Information:

Tel: 0845 120 4521

Fax: 0800 138 8881

Repairs:

Tel: 0845 120 3211

Technical Support:

E-mail: techsupport@philipharris.co.uk

www.philipharris.co.uk

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