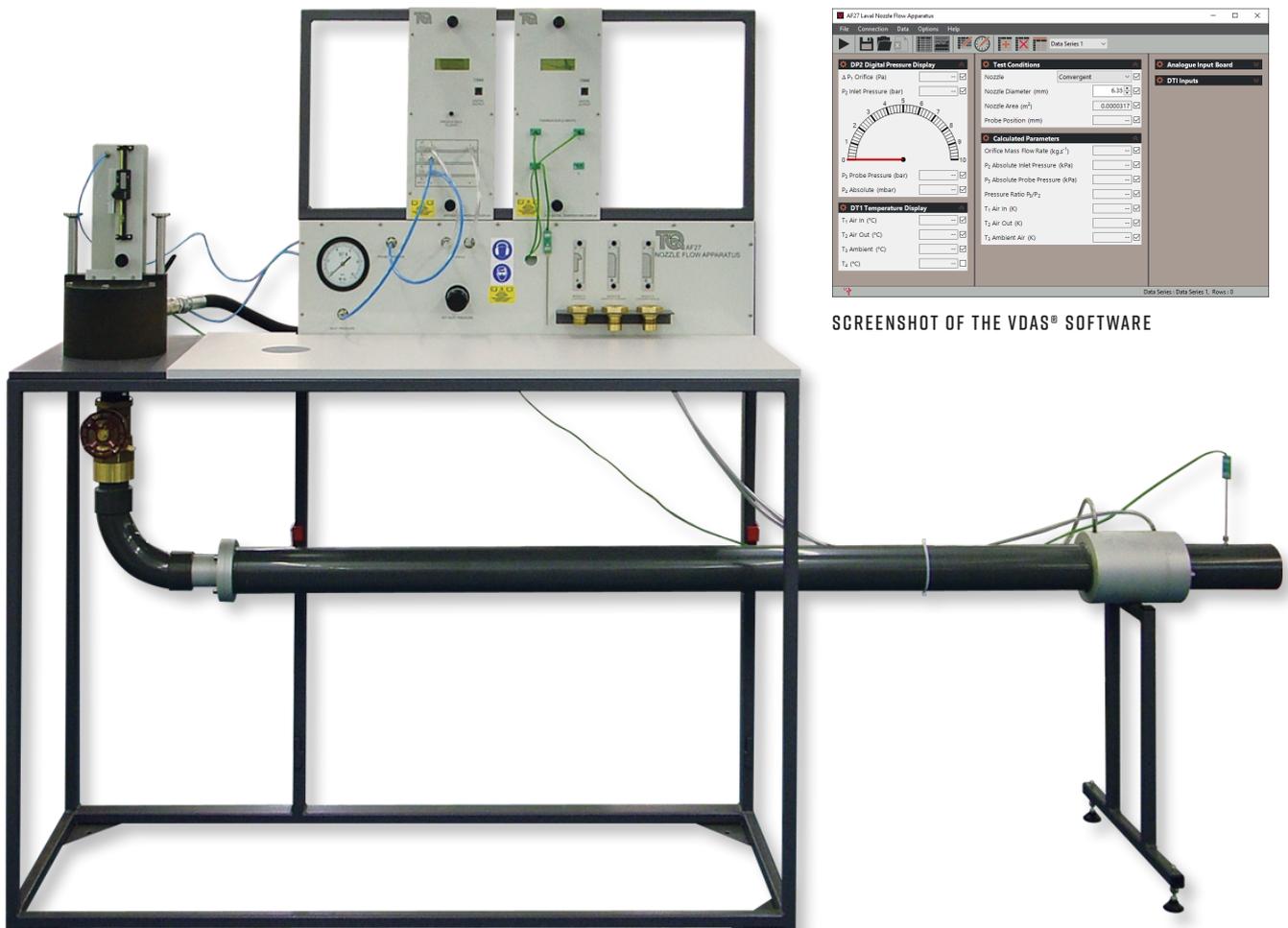




# LAVAL NOZZLE PRESSURE APPARATUS

**VDAS® AF27**

Demonstrates the thermodynamic and fluid mechanics of the adiabatic expansion of air through subsonic and supersonic nozzles. Includes interchangeable convergent, convergent/divergent Laval nozzles and convergent/parallel nozzle.



SCREENSHOT OF THE VDAS® SOFTWARE

## KEY FEATURES

- Floor-standing apparatus that demonstrates the thermodynamics and fluid mechanics of the adiabatic expansion of air through subsonic and supersonic nozzles
- Connects to suitable laboratory compressed air supply or TecQuipment's optional Compressor (AF27a)
- Includes three interchangeable, profiled and polished brass nozzles: convergent, convergent/divergent and convergent/parallel
- Built-in instrument frame and worktop
- Electronic instruments measure and display multiple pressures and temperatures at the same time, for ease of use and for connection to TecQuipment's VDAS®
- Works with TecQuipment's Versatile Data Acquisition System (VDAS®) for instant recording of multiple readings and automatic calculations



# LAVAL NOZZLE PRESSURE APPARATUS

**VDAS**® AF27

## DESCRIPTION

The apparatus connects to TecQuipment's optional Compressor (AF27a) or a suitable laboratory supply of dry, clean compressed air. It demonstrates the thermodynamic and fluid properties of the adiabatic expansion of subsonic and supersonic air flow through nozzles.

Its floor-standing frame holds:

- a pressure chest with a removable lid and nozzle traverse mechanism;
- a useful worktop;
- a pressure regulator to maintain the inlet/upstream pressure, with an analogue reference pressure gauge;
- three interchangeable, profiled and polished brass nozzles with mimics that fit on the traverse mechanism;
- an instrument frame with digital pressure and temperature displays.

A nozzle is fitted to the chest. Compressed air passes through the pressure regulator and an isolating valve. It then enters the pressure chest and passes vertically down through the nozzle, then through a precision downstream valve. The air flow then settles as it passes along a horizontal pipe, through an orifice and out to atmosphere.

The temperature and pressure displays accurately measure temperatures and pressures at key points around the apparatus, including the pressures around the orifice which students use to determine overall mass flow.

For ease of visibility and for good engineering practice, the analogue gauge also shows pressure in the chest.

A stainless steel probe on a manually adjustable, vertical traverse measures the pressure distribution along the axis of the nozzle. A digital indicator measures the probe position in the nozzle. The traverse mechanism includes a pointer and a mounting for a 'mimic' of each nozzle. The pointer moves along the mimic to help students visualize the position of the probe.

The instrument frame has extra space for the optional VDAS® interface unit. VDAS® allows accurate real-time data capture, monitoring, display, calculation and charting of all the important readings on a suitable computer (computer not included).

## STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Made in accordance with the latest European Union directives
- An ISO 9001 certified company

## LEARNING OUTCOMES

- The relationship between pressure ratio and flow for convergent and convergent/divergent Laval nozzles
- The pressure profile in convergent/divergent nozzles at various pressure ratios
- Investigation of expansion with friction in a parallel passage at high subsonic velocities
- Boundary layer growth under subsonic and supersonic conditions
- The phenomenon of choked flow corresponding to sonic velocity at a nozzle throat

## ESSENTIAL ANCILLARIES

- Compressor (AF27a)

## RECOMMENDED ANCILLARIES

- Versatile Data Acquisition System – Frame-mounted version (VDAS-F)

## ESSENTIAL SERVICES

### ELECTRICAL SUPPLY:

50 Hz to 60 Hz 90 VAC to 250 VAC for the instruments of the Nozzle Flow Apparatus.

Supply for the optional Compressor (AF27a) is determined on order.

### AIR SUPPLY NEEDED (IF NOT USING AF27A):

Clean, dry air at  $125\text{m}^3\cdot\text{h}^{-1}$

Minimum 7 bar, maximum 10 bar

Air connection: 3/4" BSP

### FLOOR SPACE NEEDED:

3.9 m x 2 m for the Nozzle Flow Apparatus (including 1 m of free space in front of outlet)

Nominally 2.5 m x 1.5 m for the Compressor (AF27a)

## OPERATING CONDITIONS

### OPERATING ENVIRONMENT:

Laboratory

### STORAGE TEMPERATURE RANGE:

-25°C to +55°C (when packed for transport)

### OPERATING TEMPERATURE RANGE:

+5°C to +40°C

### OPERATING RELATIVE HUMIDITY RANGE:

30% to 95% (non-condensing)

## SOUND LEVELS

# ≡ LAVAL NOZZLE PRESSURE APPARATUS

**VDAS**® AF27

This equipment emits sound levels greater than 100 dB(A).  
You must wear ear defenders when you use it or work near to it.

## **SPECIFICATIONS**

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

### **DIMENSIONS AND WEIGHT:**

Nett: Length 2900 mm x depth 600 mm x height 1730 mm  
and 123 kg (including instruments)

Packed: 4.0 m<sup>3</sup> and 218 kg