

tests which allowing for creation of continuous frequency maps. Additionally ~~to~~ for high accuracy, the concept allows ~~to~~ the ~~association~~ of flow structure to the position of the control valve rather than to time.

## 2 Experimental method

### 2.1 Experimental stand

Figure 1 presents ~~the~~ a single-stage, open-loop, low speed compressing unit under investigation. ~~The R~~ rotor has ~~an~~ a inlet radius  $R_{in}=63mm$  at the mid-span, and ~~an~~ a outlet radius  $R_{out}=165mm$ . ~~The span~~ which ~~decreases~~ d from  $S_{in}=40mm$  to  $S_{out}=15mm$ . ~~The H~~ impeller ~~was~~ is semi-open, and the blade tip clearance varies ~~s~~ d between  $d_{in}=2.3mm$  and  $d_{out}=0.8mm$ . ~~The R~~ rotor ~~was~~ is followed by a vaneless diffuser with parallel walls and external radius  $R_{diff}=238mm$ . The volute has ~~d~~ a circular cross-section which ~~is~~ is gradually changed ~~ing~~ ing into a rectangular shape at the tongue (5mm x 15mm). ~~The V~~ volute ~~was~~ is connected to the outlet pipe of radius  $R_{pout}=75mm$ . ~~A T~~ hrottling valve ~~was~~ is situated at the pipe outlet. The length of a single impeller passage varies ~~s~~ d from 174mm at hub to 134mm at the shroud tip ~~that~~ gives ~~ing~~ ing an average  $L_p=154mm$ . The area of the passage cross-section at the impeller inflow ~~was~~ is  $A_{p-in}=823mm^2$  and  $A_{p-out}=676mm^2$  at the outflow. The volume between  $A_{p-out}$  and the valve ~~inlet~~ was ~~equal to~~  $V_0=0.125m^3$ . According to [1], this volume can be treated as the volume of a Helmholtz resonator with frequency given by the equation 1:

$$f_H = \frac{c}{2\pi} \sqrt{\frac{A_{p-out}}{L_p V_0}} = 10.3Hz \quad (1)$$

~~The~~ The inlet pipe has ~~a~~ a radius  $R_{pin}=150mm$  and ~~was~~ is connected to the guideless inlet by a nozzle. It was specially formed in ~~the~~ a shape of a Witoszynski nozzle [4] to assure uniform inflow to the impeller. ~~The R~~ rotor ~~was~~ is driven by an asynchronous AC engine (400V/15kVA). ~~The machine~~ was ~~designed~~ is designed to work at ~~an~~ an ambient conditions and nominal working conditions are attained at  $f_{rot}=120Hz$ ,  $m=0.8 \frac{kg}{s}$  and  $\pi_p=1.12$ . However, in this study, in order to avoid risk of impeller damage at surge, the unit was run with a lower rotational speed ~~of~~ of  $f_{rot}=100Hz$  with a flow rate of ~~at~~ at  $m=0.75 \frac{kg}{s}$  and pressure ratio,  $\pi_p=1.08$ . ~~The Impeller~~ has ~~23~~ 23 blades, hence the Blade Passing Frequency ~~is~~ is equal to  $f_{BPS}=2.3kHz$ .

### 2.2 Measurement methodology

~~The test S~~ stand ~~was~~ is equipped with 7 subminiature Kulite transducers connected to an Iotech Wavebook 516/E data acquisition system. ~~five~~ five of the ~~transducers~~ transducers ~~were~~ are mounted flush ~~on~~ on the shroud walls to measure the static pressure, ~~two~~ two ~~were~~ are built

**Comment [GL6]:** The author may wish to write "The volume enclosed..."

**Comment [GL7]:** The author may wish to write "AC motor..."