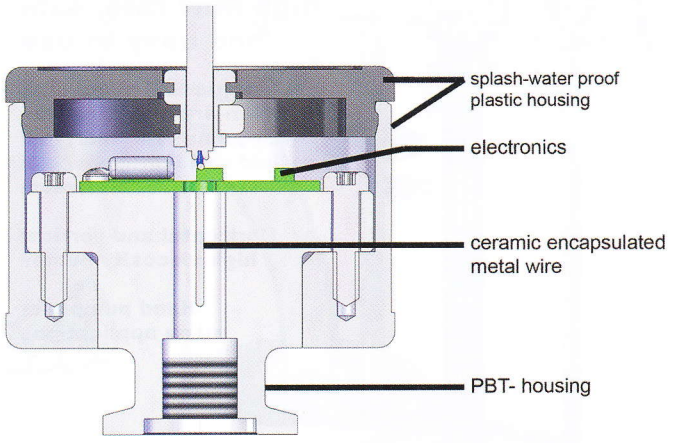
Fine vacuum measurement

Pirani sensor with high chemical and mechanical resistance

For vacuum measurement of e.g. rotary vane pumps the VSP 3000 has a chemical and mechanical robustness which is unequalled by conventional Pirani sensors up to now. Its ceramic protective covering of the metal wire and a splash-watertight plastic housing make it a reliable fine vacuum gauge, which is easy to use and offers high life expectancy. The application possibilities range from the fine vacuum measurement and regulation up to continuously precise measurements of rough vacuum down to fine vacuum.

Many lab applications like residual drying, lyophilization or short-path distillation need ultimate vacuum and measurement in the fine vacuum range (0.001 to 1 mbar) where, for example, rotary vane pumps and Pirani gauges are combined. In particular, vacuum processes with chemically aggressive gases and vapors typically lead to corrosion of the Pirani filaments and to a build up of deposits on their surface from the oil vapours coming from the rotary vane pump and process products. As a consequence of this corrosion and deposit build up the measurement becomes inaccurate. It can even lead to a complete failure of the sensor.



The VSP 3000 (sectional drawing at the left) can be used in combination with the vacuum controller CVC 3000 (above) providing additionally for vacuum regulation in the fine vacuum range

Even the careful choice of chemically resistant materials for the metal wire or its coating cannot prevent the problem of deposition. The influence of depositions can be estimated roughly from the relation of deposition layer thickness to wire diameter. Because the metal wire is very thin (typical 0.01 mm) the relative measuring error is already very big even with slight depositions.

To solve these problems Vacuubrand has developed the Pirani sensor VSP 3000. At the heart of this technological innovation is a ceramic measuring element whose construction and impact fulfils at the same time several important functions:

- As a gasproof ceramic cover it protects the metal wire against corrosion.
- As an isolating protective coating it separates the metal wire from conductive depositions and prevents a change of the electric properties of the wire.
- The special surface quality of the ceramic material reduces the formation of depositions on the protective covering.
- The ceramic cover increases the diameter of the measuring element by a factor of 100 and thus reduces the influence of a possible deposition layer on the measuring result.

The breaking of the thin metal filament in conventional Pirani sensors is also a well-known problem. The delicate filaments react very sensitively to quick pressure changes or to mechanical stress which appear, for example, with quick venting or vibration of the vacuum pump. With the VSP 3000 the ceramically enclosed metal wire is no longer exposed to the gas and vapor stream, so it becomes very stable against sudden pressure changes. Additionally the ceramic protective covering encloses the metal wire completely and improves its mechanical stability. All together this stabilisation results in a vastly improved life expectancy of the sensor.

Inaccuracies in the indicated measuring values based on depositions and corrosion appear more quickly and frequently, the higher the concentration is of the gases or vapors to be measured. Whilst the fine vacuum range is not yet reached, the filament must be protected in conventional sensors against high concentrations of gases and vapors. Therefore, traditionally Pirani sensors are separated from the application using valves. The VSP 3000 with its gas proof protective covering negates the need for this additional valve protection.

Cleaning of the filament is necessary for all Pirani sensors for reliable pressure measurements. Usually this process carries with it a high risk of destroying or damaging the fragile metal filament. The VSP 3000 with its protective covering and open geometry allows for easy optical control and trouble-free cleaning.

The VSP 3000 covers the measuring range from 0.001 to 1000 mbar. Its precision, resolution and reproducability of measurement and response time to pressure changes is equal or even better to that of conventional Pirani sensors. The gauge set assembly with the VSP 3000 can be combined with an additional capacitive vacuum sensor (VSK 3000) which allows for the continuous precise measurement from atmospheric pressure all the way down to fine vacuum.

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