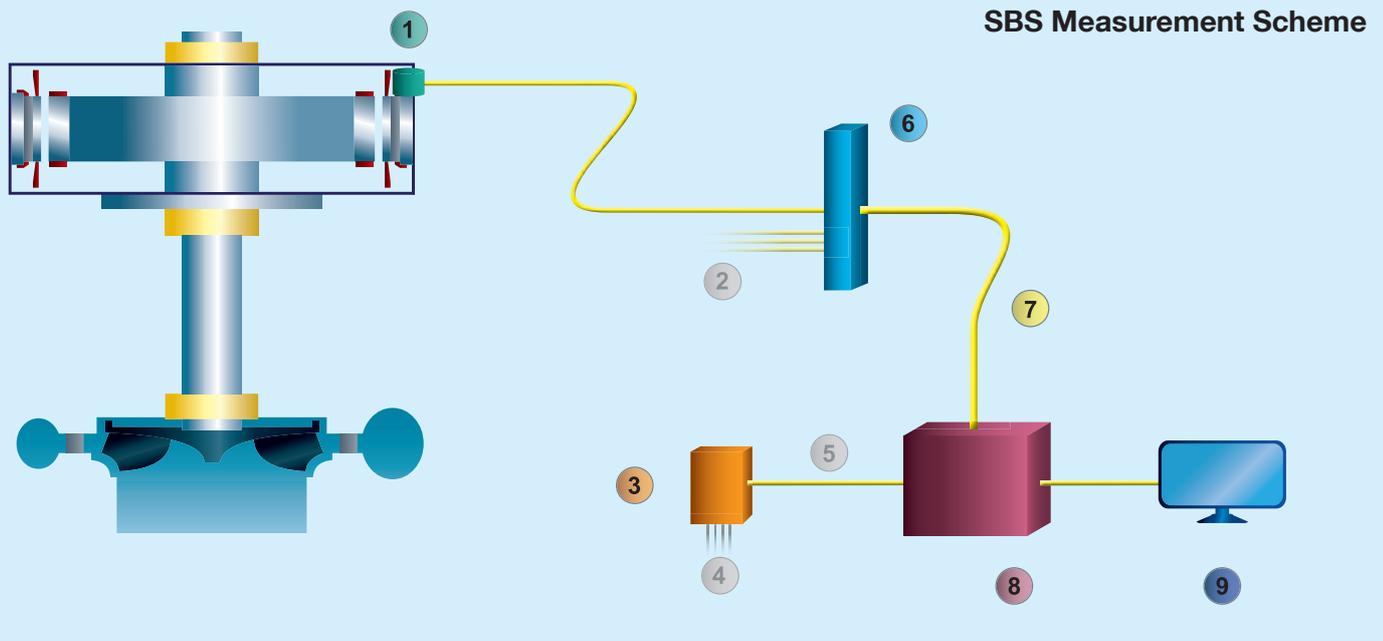


# DIA TECH SBS

## Structure Borne Sound Diagnosis



- |  |                                    |  |                      |     |                             |                          |                     |                         |
|--|------------------------------------|--|----------------------|-----|-----------------------------|--------------------------|---------------------|-------------------------|
| 1  | 2                                  | 3  | 4                    | 5   | 6                           | 7                        | 8                   | 9                       |
| Accelerometer preferably mounted on stator pressure plates | Vibration Signals from other units | SCADA (Supervisory Control and Data Acquisition) | Auxiliary Parameters | LAN | High-speed acquisition unit | High-speed data transfer | Monitoring Computer | Grafical User Interface |

**DIA TECH SBS provides** diagnosis for the early detection of condition changes of the stator core (including pressure plate, pressing bolts as well as winding bars) caused by loosening. The physical phenomenon of structure borne-sound is used to assess the second order harmonic of line frequency and its multiples, which are excited by electro-magnetic field. The structure-borne sound is spread over the whole mechanical structure but only slightly damped.

### Acquisition of measured values

The structure-borne sound will be measured by means of one or more acceleration detectors mounted on the stator core preferably on the pressure plate. The measuring chain – consisting of accelerometer, signal amplifier and fast analogue/digital converter (ADC) – delivers a “raw” vibration signal, which will be transferred into the

computer for signal processing and stator core assessment. The acceleration signal is measured from 1 to 6400 Hz.

### Processing of measured values

The DIA TECH SBS software makes the

frequency analysis from the raw signals by Fast Fourier Transformation (FFT). The analysis is further processed by the “Cepstrum” method for improved assessment. The information of actual load condition helps to enable useful interpretations.

As an addition to the basic value **v<sub>rms</sub> [mm/s]** the **Cepstrum** calculates two artificial signal-characteristic quantities (**CEP<sub>arms</sub>** and **SBS<sub>val</sub>**) by using the mathematical function of Fourier-inverse-transformation.

**v<sub>rms</sub> [mm/s]** is defined as the **Quadratic averaged velocity vibration** of the measured broadband acceleration (1 – 6400 Hz). This is a measure of the vibration level. (rms = Root Mean Square);

**CEP<sub>arms</sub> [%]** is defined as the **artificial characteristic value** calculated by the SBS algorithm. It serves to evaluate the amplitude of the double net-frequency Cepstrum of the re-

spective acceleration signal. 0 % = theoretically the best case, that would mean a pure natural vibration frequency spectrum. 100 % = theoretically the worst case, that corresponds to the maximum “line spectrum”, which is the vibration answer to a fully loosened system caused by the double net-frequency forced excitation. CEP<sub>arms</sub> [%] is consequently a measure of the mechanical condition of the stator.

**SBS<sub>val</sub>** is defined as the **Validation of the CEP<sub>arms</sub> in combination with v<sub>rms</sub>**. This value leads to the characteristic SBS evaluation (smaller value is better).

# DIA TECH SBS

## Structure Borne Sound Diagnosis

### Acquisition requirements:

#### Required hardware:

- Accelerometer of piezo-resistive type
- A/D-conversion (PC-plug in card or external ADC)
- Signal amplifier

#### Auxiliary parameters for diagnosis

- Active power
- Reactive power

### Main specification:

#### Number of accelerometers:

One (1) sensor for small units; large units should be equipped with sensors mounted at about every 4 m along the stator periphery.

#### Pre-processing at front-end ADC:

- Sample rate: 16384 samples / sec
- Frequency range of measurement: 1 to 10 kHz

#### Processing at computer:

- Frequencies of evaluation: multiples of double net-frequency 100 (120) Hz
- Cepstrum values: CEP\_arms and SBS\_val

#### Limit monitoring

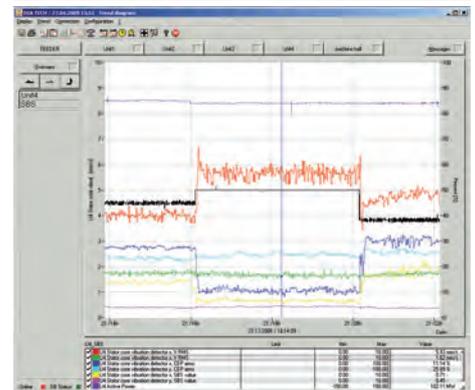
(pre-warning, warning) upon SBS\_val

#### System requirements:

DIA TECH SBS requires the data management software package DIA TECH CORE. All DIA TECH Modules are running on standard personal computers and a Windows®-based platform.

### Available DIA TECH Knowledge Modules:

- DIA TECH CAA-HS (Cooling air analysis – hotspot detection)
- DIA TECH CAA-O3 (Cooling air analysis – ozone diagnosis for surface partial discharge)
- DIA TECH CAV (Cavitation monitoring)
- DIA TECH IRD (Rotor pole temperature module based on infrared measurement)
- DIA TECH MFX (Magnetic flux monitoring)
- DIA TECH MGM (Machine gap monitoring module for air gap and turbine clearance)
- DIA TECH RTMP (Rotor winding temperature module based on calculation)
- DIA TECH SBS (Structure borne sound diagnosis for stator core vibration)
- DIA TECH ThM (Thermal diagnosis for stator core & winding and cooling circuit)
- DIA TECH CORE (Data management package with graphical user interface)
- DIA TECH TPOT (Turbine / pump operation time counter)



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