		Faults vs. measurements			
Faults	**Measurements type**	**CoDiS Real Time Analysis**	**CoDiS Standard Analysis Tools**	**CoDiS Advanced Tools**	**Business Case**
Mechanical unbalance	Relative shaft vibrations	s1n A&Ph	Orbit and FFT (spectral) analysis dBase data trends	CoDiS balancing module	Detection of changes in mechanical structure or change in rotor balance that can lead to excessive vibrations. Possible solution – using CoDiS balancing module.
	Absolute bearing bracket vibrations				
Electrical unbalance	Relative shaft vibrations	s1n A&Ph	Orbit and FFT (spectral) analysis dBase data trends Rotorand Pole inter-turn short circuit analysis	Measuring rotor/stator offset Detecting pole number with inter-turn short circuit	Detection of poor rotor geometry (eccentricity) which might be causing magnetic field asymmetry. Detection of pole winding inter turn short circuit.
	Absolute bearing bracket vibrations				
	Magnetic field	MXDiff			
	Air gap	Rotor CL			
Bearing stiffness	Relative shaft vibrations	s1n(A&Ph) during over speed and free coast down	Bode plot, Nyquist plot Transfer fctn. trend	Detecting direction of bearing stiffness changes and critical speed changes	Detection of changes in structure and bearing stiffness. Detection of critical speed changes.
	Absolute bearing bracket vibrations				
Shaft misalignment	Relative shaft vibrations	s1n, s2n, DC during free coast down and slow roll	Absolute bearing bracket vibrations Run out and shaft centreline analysis	Advanced CoDiS slow roll module	Detection of inadequate shaft centreline position within the bearings Detection of bearing clearance violation. Measurement of rotor shaft vertical alignment.
Eccentricity of stator to rotor	Relative shaft vibrations	DC	2D and 3D orbits w/DC Air gap eccentricity Linear and polar magnetic field analysis	Advanced 2D rotor and stator shape module	Misalignment of stator and rotor causing pulling magnetic force (unbalanced magnetic pull) to the rotor that can lead to possible damage to the bearings.
	Air gap	Eccentricity			
	Magnetic field	MXDC			
Loose Rotor Rim	Air gap Magnetic Field	Dynamic eccentricity -S1n and s2n	Air Gap real time analysis Rotor pole profile	Advanced rotor and stator shape module	Loose rotor rim indicating the lower stiffness of rotor body that can lead to fatigue cracks , loose rotor parts and eventually to rotor/stator rub
Bearing wear and failures	Absolute bearing bracket vibrations	Rest (non s1n + s2n + s3n)	Orbit and FFT (spectral) analysis (s0.5n detection) dBase data Trends		Bearing Babbitt damage leading to high vibrations and causing high temperatures. Detection of poor oil-film conditions.
	Bearing pads and lubricant temperatures	Bearing pads (white metal) and lubricant (oil) temp			
	Relative shaft vibrations	Rest (non s1n, s2n and s3n)			
Stator vibrations	Stator core absolute vibrations	RMS A&Ph (overall, 100 Hz, 200 Hz,	Orbit and FFT (spectral) analysis	CoDiS off-line impact Eigen-frequencies	Loosened stator bars causing insulation damages leading to reducing of insulation lifetime and probable faults.

	Stator frame absolute vibrations	300 Hz)	(100 Hz harmonics) dBase data Trends	Measurement module	Detecting changes in stator core stiffness with significant impact to machine behaviour.
Insulation wear	Partial discharge	/	Trends	PD software tools	Detection of stator insulation deterioration causing couple of weeks of outage.
Pole profile change	Air gap	Pole profile analysis	Rotor shape module Magnetic field profile Orbit analysis		Detection of loose rotor pole causing increased vibrations and changed mechanical and electrical unbalance – significant changes in rotor profile.
	Magnetic field	Pole profile analysis			
	Relative vibrations	s1n(A&Ph)			
Turbine cover stiffness	Axial displacements	DC	FFT (spectral) and dBase data Trends analysis	Advanced Turbine cover analysis module with fault locator	Detection of stiffness change and possible mechanical cracks of turbine cover itself and turbine bolts failure.
	Turbine cover vibrations	RMS A&Ph (overall, non-s1n) No of blade multipliers harmonics			
Stator core shape	Air gap	AG pole profile from multiple probes	Polar display and stator core shape calculation		Detection of stator inner shape (stator core) stability.
Stator frame shape	Relative frame displacement	Displacement	Polar display and stator frame shape calculation	Transfer fctn analysis with fault possibility estimation	Detection of stator outer shape (stator frame) stability.

Legend:

sxn – Vibrations on first harmonic of rotational frequency (x = 0.5, 1, 2, 3,... n)

A – Amplitude

Ph – Phase

DC – shaft centerline

MXDiff – Magnetic Flux adjacent pole difference (mT)

MXDC – Magnetic flux average from all poles

R;S – Root Mean Square

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