ISO Standard 17359:2018

Annex A - Examples of condition monitoring parameters

Table A .1 — Examples of condition monitoring parameters by machine type

Parameter	Machine type									
	Electric motor	Steam turbine	Aero gas turbine	Industrial gas turbine	Pump	Compressor	Electric Generator	RIC engine	Fan	Power Transformer
Temperature	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Pressure		◉	◉	◉	◉	◉		◉	◉	◉
Pressure (head)					◉					
Pressure ratio			◉	◉		◉				
Pressure (vacuum)		◉			◉					
Air flow			◉	◉		◉		◉	◉	
Fuel flow			◉	◉				◉		
Fluid flow		◉			◉	◉				
Current	◉						◉			◉
Voltage	◉						◉			◉
Resistance	◉						◉			◉
Electrical phase	◉						◉			
Input power	◉				◉	◉	◉		◉	◉
Output power	◉	◉	◉	◉			◉	◉		◉
Noise	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Vibration	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Acoustic emission	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Ultrasonics	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Oil pressure	◉	◉	◉	◉	◉	◉	◉	◉	◉	
Oil Consumption	◉	◉	◉	◉	◉	◉	◉	◉	◉	
Oil (tribology)	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Thermography	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Torque	◉	◉		◉		◉	◉	◉		
Speed	◉	◉	◉	◉	◉	◉	◉	◉	◉	
Length		◉								
Angular position		◉	◉	◉		◉				
Efficiency (derived)		◉	◉	◉	◉	◉		◉		

◉ Indicates condition monitoring measurement parameter is applicable.

Key
RIC: Reciprocating internal combustion
NOTE: This table contains examples and is not an exhaustive list. Other parameters may be appropriate to consider.

ISO Standard 17359:2018

Table B .2 — Example of electric motor faults matched to measurement parameters and techniques

Machine type: Electric motor	Symptom or parameter change												
Examples of faults	**Current**	**Voltage**	**Resistance**	**Partial discharge**	**Power**	**Torque**	**Speed**	**Vibration**	**Temperature**	**Coast down time**	**Axial flux**	**Oil debris**	**Cooling gas**
Rotor windings	◉				◉	◉	◉	◉	◉		◉		◉
Stator windings	◉							◉	◉		◉		◉
Eccentric rotor	◉							◉			◉		
Brush(es) fault	◉	◉			◉	◉			◉				
Bearing damage	◉					◉		◉	◉	◉		◉	
Insulation deterioration	◉	◉	◉	◉									◉
Loss of input power phase	◉	◉						◉			◉		
Unbalance								◉					
Misalignment								◉					

◉ Indicates symptom could occur or parameter could change if fault occurs.

Table B.3 — Example of steam turbine faults matched to measurement parameters and techniques

Machine type: Steam turbine	Symptom or parameter change									
Examples of faults	Steam leakage	Length measurement	Power	Pressure or vacuum	Speed	Vibration	Temperature	Coast down time	Oil debris	Oil leakage
Damaged rotor blade	◉		◉			◉	◉	◉	◉	
Damaged labyrinth	◉		◉	◉	◉	◉	◉	◉		
Eccentric rotor	◉					◉		◉		
Bearing damage		◉	◉	◉		◉	◉	◉	◉	◉
Bearing wear	◉	◉				◉	◉	◉	◉	◉
Hogging or sagging rotor	◉					◉		◉	◉	
Unequal expansion	◉	◉				◉	◉			
Unbalance						◉				
Misalignment						◉				

◉ Indicates symptom could occur or parameter could change if fault occurs

Table B.4 — Example of aero gas turbine faults matched to measurement parameters and techniques

Machine type: Aero gas turbine	Symptom or parameter change											
Examples of faults	Compressor temperature	Compresor pressure/ Pressure ratio	Air flow	Fuel pressure/ Fuel flow	Speed	Gas generator temperature	Pressure/ Pressure ratio	Power turbine temperature	Exhaust temperature	Vibration	Oil debris	Oil leakage/ consumption
Air inlet blockage	◉	◉	◉		◉							
Compressor fouled	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	
Compressor damaged	◉	◉		◉	◉	◉	◉	◉	◉	◉	◉	
Compressor stall					◉		◉			◉		
Fuel filter blockage		◉		◉	◉		◉					
Seal leakage						◉	◉				◉	◉
Combustion chamber holed				◉	◉				◉			
Burner blocked				◉	◉		◉					
Power turbine dirty	◉	◉	◉		◉		◉	◉		◉		
Power turbine damage	◉	◉	◉		◉		◉			◉	◉	
Bearing wear/damage										◉	◉	◉
Gear defects										◉	◉	
Unbalance										◉		
Misalignment										◉		

◉ Indicates symptom could occur or parameter could change if fault occurs.

ISO Standard 17359:2018

Table B.5 — Example of industrial gas turbine faults matched to measurement parameters and techniques

Machine type: Industrial gas turbine	Symptom or parameter change											
Examples of faults	Compressor temperature	Compressor pressure	Air flow	Fuel pressure/ Fuel flow	Speed	Exhaust temperature	Vibration	Output power	Compressor efficiency	Turbine efficiency	Oil debris/ contamination	Oil consumption
Air inlet blockage		◉	◉		◉			◉				
Compressor fouled	◉	◉	◉	◉	◉			◉	◉			
Compressor damaged	◉	◉	◉	◉	◉		◉	◉	◉		◉	
Fuel filter blockage		◉		◉	◉			◉				
Combustion chamber holed				◉	◉			◉				
Burner blocked				◉	◉	◉		◉				
Power turbine damaged					◉	◉	◉	◉		◉	◉	
Bearing wear							◉				◉	◉
Unbalance							◉					
Misalignment							◉					

◉ Indicates symptom could occur or parameter could change if fault occurs.

ISO Standard 17359:2018

Table B.6 — Example of pump faults matched to measurement parameters and techniques

Machine Type: Pumps	Symptom or parameter change									
Examples of faults	**Fluid leakage**	**Length measurement**	**Power**	**Pressure or vacuum**	**Speed**	**Vibration**	**Temperature**	**Coast down time**	**Oil debris**	**Oil leakage**
Damaged impeller		◉	◉	◉	◉	◉	◉	◉	◉	
Damaged seals	◉	◉		◉	◉	◉				
Eccentric impeller			◉	◉	◉	◉	◉	◉		
Bearing damage		◉	◉		◉	◉	◉	◉	◉	◉
Bearing wear		◉				◉	◉	◉	◉	
Mounting fault						◉				
Unbalance						◉				
Misalignment		◉				◉				

◉ Indicates symptom could occur or parameter could change if fault occurs.

ISO Standard 17359:2018

Table B.7 — Example of compressor faults matched to measurement parameters and techniques

Machine type: Compressors	Symptom or parameter change									
Examples of faults	Fluid leakage	Length measurement	Power	Pressure or vacuum	Speed	Vibration	Temperature	Coast down time	Oil debris	Oil leakage
Damaged impeller		◉	◉	◉	◉	◉	◉	◉	◉	
Damaged seals	◉	◉		◉	◉				◉	
Eccentric impeller			◉	◉	◉	◉	◉	◉		
Bearing damage		◉	◉		◉	◉	◉	◉	◉	◉
Bearing wear		◉				◉	◉	◉	◉	
Cooling system fault	◉			◉			◉		◉	
Valve fault	◉			◉		◉	◉			
Mounting fault						◉				
Compressor stall		◉			◉	◉				
Unbalance						◉				
Misalignment		◉				◉				

◉ Indicates symptom could occur or parameter could change if fault occurs.

ISO Standard 17359:2018

Table B.8 — Example of RIC engine faults matched to measurement parameters and techniques

Machine type: RIC engine	Symptom or parameter change											
Examples of faults	Engine temperature	Cylinder pressure	Air flow	Fuel pressure	Fuel flow	Exhaust temperature	Exhaust pressure	Vibration	Output power	Oil consumption	Oil debris	Cooling fluid leak
Air inlet blockage	◉	◉	◉				◉					
Fuel injector fault	◉	◉	◉		◉	◉		◉	◉	◉		
Ignition fault	◉	◉			◉	◉		◉	◉	◉		
Bearing wear								◉			◉	
Fuel filter blockage				◉	◉		◉					
Seal leakage						◉	◉			◉		
Piston ring fault		◉							◉	◉	◉	
Cooling system fault					◉		◉			◉	◉	◉
Secondary balance gear fault								◉				
Gear defects								◉			◉	
Flywheel damage								◉			◉	
Mounting fault								◉				
Unbalance								◉				
Misalignment								◉				

◉ Indicates symptom could occur or parameter could change if fault occurs.
RIC Engine = Reciprocating Internal Combustion Engine

Table B.9 — Example of electric generator faults matched to measurement parameters and techniques

Machine type: Electric generator	Symptom or parameter change												
Examples of faults	**Current**	**Voltage**	**Resistance**	**Partial discharge**	**Power**	**Torque**	**Radio frequency emissions**	**Vibration**	**Temperature**	**Coast down**	**Axial flux**	**Oil debris**	**Cooling gas**
Rotor windings	◉							◉	◉		◉		◉
Stator windings	◉							◉	◉		◉		◉
Eccentric rotor	◉							◉			◉		
Brush(es) fault	◉	◉			◉	◉	◉		◉				
Bearing damage						◉		◉	◉	◉		◉	
Insulation deterioration	◉	◉	◉	◉									◉
Loss of output power phase	◉	◉						◉					
Unbalance								◉					
Misalignment								◉					

◉ Indicates symptom could occur or parameter could change if fault occurs.

ISO Standard 17359:2018

Table B .10 — Example of fan faults matched to measurement parameters and techniques

Machine type: Fans	Symptom or parameter change									
Examples of faults	Air leakage	Length measurement	Power	Pressure or vacuum	Speed	Vibration	Temperature	Coast down time	Oil debris	Oil leakage
Damaged impeller		◉	◉	◉	◉	◉	◉	◉	◉	
Damaged oil seals		◉		◉	◉				◉	◉
Damaged bellows	◉									
Eccentric impeller			◉	◉	◉	◉	◉	◉		
Bearing damage		◉	◉		◉	◉	◉	◉	◉	◉
Bearing wear		◉				◉	◉	◉	◉	
Mounting fault						◉				
Rotor fouled						◉				
Unbalance						◉				
Misalignment		◉				◉				

◉ Indicates symptom could occur or parameter could change if fault occurs.

Table B.11 — Examples of power transformer faults matched to measurement parameters and techniques

Equipment type: Power transformer	Symptom or parameter change or detection technique															
Examples of faults	Amps/ volts/load	Visual	Oil condition	Temperature	Partial discharge	DGA	Noise	Ultra sound	Vibration	Power Factor / Tan δ	Resistance	DFR/ PDC/ RVM	FRA	Excitation current	Leak reactance flux	Bushing capacitance
Insulation deterioration	◉		◉	◉	◉	◉		○		◉	◉	◉	◉	◉		
Moisture ingress/ content			◉			◉				◉	◉	◉				
On-load tap changer condition/ fault	◉		◉	◉	○	◉	○	◉	○		◉		◉	◉		
Deenergized tap changer condition/ fault	◉		◉	◉	○	◉	○	◉	○		◉		◉	◉		
Oil quality deterioration			◉			◉				◉		◉				
Arcing/ electrical discharge		◉	◉		◉	◉	◉	◉		◉						
Connection/ bushing faults				◉	◉	○	○	◉		◉	◉					◉
Overheating/ auxiliary cooling system fault		○	◉	◉		◉		○								
Low oil level		◉	○	○		○	○	○								
Oil circulation system problem		◉	○	◉		○										
Winding distortion								○				◉	◉		◉	
Winding Looseness							◉	◉	◉							
Core Looseness							◉	◉	◉							
Oil leak		◉														
External damage/ disturbance		◉														
Through fault e.g. lightning strike										◉			◉			
Supply faults, e.g. excessive harmonics and over fluxing	○															

◉ Indicates symptom could occur or parameter could change if fault occurs.
○ Indicates less common symptom or parameter.

Key

DGA: Dissolved gas analysis DFR: Dielectric frequency response FRA: Frequency response analysis
PDC: Polarization and de-polarization current RVM: Recovery voltage method Tan δ (tan-delta): Tangent dissipation angle

NOTE: For more details see ISO 18095.