PERFORMANCE SUMMARY

Bottom Line Call

The bottom line call on the report or results screen come from a very simple algorithm. If there are no problems with the motor an “operating normally” call will be made. If there are current variation, voltage variation and/or overload problems with the motor an “abnormal indications” call will be made. If there are problems with the motor other than those for current, voltage or load, then a “suspicious operation” call will be made.

Power Factor Commentary

There are many articles and books covering this subject and it would take considerable detail to fully cover, suggest obtaining additional material, but essentially a power factor other than unity results in lower plant efficiency

Current Commentary

If the transformer harmonic derating factor (THDF) is between 97.5% and 105%:
THDF is acceptable, waveform is generally sinusoidal.

If the THDF is less than 97.5%:
A current surge may have occurred and the source should be determined and corrected.

If the THDF is greater than 105%:
Clipping of the current waveform may have occurred and the source should be determined and corrected.

If the current deviation is less than 2%:
Phase current variation is acceptable, continue operation.

If the current deviation is between 2 and 3%:
Phase current varies by more than 2%; monitor for increased hot-spot temperature; do not allow to increase much more than this; consider taking steps to reduce.

If the current deviation is between 3 and 5%:
Phase current varies between 3 and 5%; operation should be limited and temperature monitoring frequency increased; variation should not be allowed to increase; steps should be taken to reduce.

If the current deviation is between 5 and 10%:
Phase current variation is between 5 and 10%; operation should be stopped until cause can be determined and corrected. Continued operation may severely overheat the motor and cause subsequent failure.

If the current deviation is greater than 10%:
MOTOR SHOULD BE STOPPED; phase current variation exceeds 10%; continued operation will lead to imminent failure; a short in the stator windings is highly likely. The high current unbalance results in unbalance of the stator magnetic field, resulting in

overheating, mechanical unbalance, and vibration. In addition, the stator coils themselves are likely to vibrate, destroying the insulation and shorting the laminations.

If the crest factor (CF) is less than 1.35:
The crest factor indicates serious waveform clipping has occurred. The source should be determined and corrected before continuing operation.

If the CF is greater than 1.45:
The crest factor indicates surging or spiking has occurred and the source should be determined and corrected before continuing operation. View the waveform for surges or spikes.

If the CF is between 1.35 and 1.45:
The crest factor indicates the waveform to be generally sinusoidal.

Voltage Commentary

Voltage
If the voltage deviation factor (VDF) is less than 75%:
Motor operation is not recommended when the VDF is less than 75%.

If a phase voltage is greater than 1.06 times the nameplate value:
A phase voltage surge has occurred and its source should be determined and corrected before continuing operation.

If a phase voltage is less than 0.875 times the nameplate value:
Phase voltage sag has occurred and its source should be determined and corrected before continuing operation.

If a phase voltage peak is greater than 1.5 times the nameplate value:
A phase voltage spike has occurred and the source should be determined and corrected before continuing operation.

If neither has occurred:
The phase voltage level is within acceptable tolerance of the nameplate value.

If the three phase average voltage level is greater than 1.06 times the nameplate value:
The three phase average voltage level is above the maximum tolerance and a surge exists. It should be corrected before continuing operation.

If the three phase average voltage level is less than 0.875 times the nameplate value:
The three phase average voltage level is below the minimum tolerance and sagging exists. It should be corrected before continuing operation.

If neither has occurred:
The three phase average voltage level is within acceptable tolerance of the nameplate value.

If the crest factor (CF) is less than 1.35:

The crest factor indicates serious waveform clipping has occurred. The source should be determined and corrected before continuing operation.

If the CF is greater than 1.45:
The crest factor indicates surging or spiking has occurred and the source should be determined and corrected before continuing operation. View the waveform for surges or spikes.

If the CF is between 1.35 and 1.45:
The crest factor indicates the waveform to be generally sinusoidal.

> Note: the product of the THDF and VDF should be considered as a recommended factor to be applied to the nameplate horsepower value to de-rate it to account for both the current waveform and voltage unbalance.

If the voltage unbalance is greater than 3%, then the source should be found and corrected. If the voltage unbalance is greater than 5%, the motor should not be run and the cause found and corrected

Load Commentary

Load
If the load on the motor is less than 25%, no rotor bar health index will be calculated and there will be an X in the box on page 1 that says, "Load is insufficient to determine rotor bar health, at this time."

Phase Connection Commentary

Verify & correct using MCA

Rotor Commentary

Rotor Severity Levels
There are seven severity levels associated with the calculation of rotor bar health index. These levels were selected in order to be consistent with diagnostic indicators found elsewhere, and in the literature. The following table presents the severity level, rotor condition, and recommended action.

If you obtain a rotor severity level of 6 or 7, please verify that the rotor damage is real as evidenced by one or more large pole pass peaks versus either of the following conditions: a high background level near the line frequency peak or the pole pass peaks riding on the shoulders of the line frequency peak.

Severity Action Level	Rotor Condition Assessment	Recommended Corrective
1.	Excellent	None
2.	Good	None
3.	Slight indication of rotor problems	Trend data

4.	Rotor bar cracks may be developing or problems with high resistance joints	Increase trending of data, trend closely
5.	One to two rotor bars cracked or broken and problems with high resistance joints likely	Increase trending and perform vibration tests
6.	Multiple cracked or broken rotor bars and end rings indicated	Overhaul ASAP
7.	Multiple broken rotor bars and end rings very likely	Overhaul or replace ASAP

If the 2nd/3rd slip harmonics are within 10% of each other:
Rotor degradation is most likely in the form of cracks.

If the slip fundamental and its harmonics all decrease:
Rotor degradation is most likely in the form of broken bars.

If there are more than three slip harmonics;
The slip (pole-pass) appears to have more than three harmonics in the demodulated spectrum. This is most likely a mechanical frequency related to rotation of some highly stressed component, such as a tight belt, a worn gear, speed reducer, or shaft whip. Multiple harmonics can also signify blow holes in cast aluminum rotors.

Stator Commentary

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Rotor/Stator Air-gap Characteristics

Indications of static eccentricity exist.
Indications of dynamic eccentricity exist.

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Harmonic Distortion Commentary

There is evidence of harmonic distortion.

Harmonic Distortion
If Total Harmonic Distortion (THD) is less than 5%:
No significant harmonic distortion appears to exist, at this time.

If THD of odd harmonics is greater than 5%:
Either the THD or odd harmonics exceed 5%, which is usually indicative of a strong 3rd or 5th harmonic. A high 3rd harmonic in voltage means there is an induced high current unbalance with probable high neutral current; thus, the problem in the motor is most likely induced by the incoming power supply leading to excessive heating in the stator windings.

When there is a strong 5th harmonic of current, it is added to the 60 Hz fundamental to produce a distorted, non-linear waveform, whose affect on the motor is to oppose

fundamental motor action. Excess heat created by the effect of higher harmonics results in the following main failure mechanisms: eddy-current losses in motor cores and conductors; degrading effect on motor torque output caused by certain harmonics of electronic equipment on the same circuit as the motor; and overall effect of having more current than the motor was designed to handle.

If positive sequence (+ve seq) harmonics are greater than 5%:
The positive sequence harmonics, the fundamental and 1/3 of all harmonic currents (4^{th}, 7^{th}, 10^{th}, etc.), support rotation or sequencing in the same direction as normal motor action. These harmonics will actually cause the motor speed to increase while adding heat to the windings.

If negative sequence (-ve seq) harmonics are greater than 5%:
The negative sequence harmonics (2^{nd}, 5^{th}, 8^{th}, etc.), oppose normal motor action and create magnetic forces on the rotor that oppose rotation, forcing the motor to work harder, drawing more current than its physical load requires. This added current could cause overheating and subsequent failure.

When a motor is subject to negative sequencing harmonic currents, the fundamental current has to increase to overcome the negative torque caused by the harmonics. This adds to the heat already generated within the motor, can cause the motor load to be reduced to save it from overheating premature failure, and can result in mechanical impacts from the negative sequencing current induced torque that can cause bearing, coupling, and rotor damage.

If zero sequence (0 seq) harmonics are greater than 5%:
The zero sequence harmonic currents (3^{rd}, 6^{th}, 9^{th}, etc.), simply create heat, but do not affect either rotating or sequencing action. Their presence indicates non-linear loads that do not cancel, but, rather, add together in the neutral conductor.

In systems with many non-linear loads, the neutral current can actually exceed the phase current. The danger here is excessive overheating because there is no circuit breaker in the neutral conductor to limit the current, as there are in the phase conductor lines.

In a three-wire delta system, these currents actually circulate within the windings, produce heat, and increase the current load. Breakers may trip if the circulating currents cause the load to increase beyond the breaker set point.

Misalignment Indications

There are indications of mechanical problems like misalignment or unbalance;
Confirm & correct using vibration analysis

Bearing Commentary

Indications of potential bearing problems
Confirm using Vibration analysis