

ELECTRIC MOTORS PROTECTION MONITOR SEAHARMONY

SEAHARMONY E-Motors monitoring devices function is rather wide. It provides Many monitoring/measurement functions, which are required for process analyzing, adjustment.

But, here we shall present the protection function of the monitor, which determine significant economical advantages (expenses saving) and safe condition of ship systems.

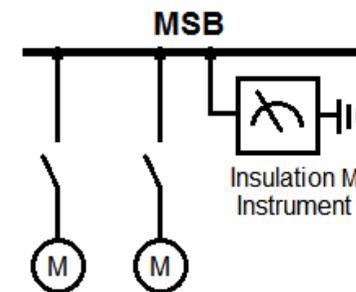


1. EL. MOTOR INSULATION RESISTANCE MONITORING /PROTECTION FUNCTION

1.1 IMPERFECTION OF CONTEMPORARY Rins MONITORING SYSTEMS

Insulation resistance of electrical equipment is very serious aspect. All ship's electrical equipment contains insulation resistance monitoring instruments. But they are still simple devices. Monitor (instrument) measures the insulation resistance of equipment via MSB bus bars. So:

- Insulation state is monitored only on galvanic connected to MSB motors – i.e. only running motors. Not connected (not running) E-Motors aren't monitored ! Low insulation alarm signaling will be initiated only after motor connection to MSB.
- Contemporary e-motors starters doesn't contain neither Rins monitoring modules, nor protection device against low insulation. So, motor, with dangerous insulation level connected to network could burn, further Low Rins alarm on MSB will be initiated, but this alert will be belated.
- Existing Instrument doesn't determine the object (location) with low insulation – only common signaling of low insulation on power network. Even in case no burning occur the failure definition of defected motor will take certain time. Sometimes the searching (localization) action by disconnection of suspicious motors is not available due to essentiality of driven mechanisms (pumps etc).



1.2 MOTOR MONITORING INSULATION RESIS. MEASUR. /PROTECTION - ADVANTAGES

The SEAHARMONY Motor protection controller provides permanent monitoring of electro motor – on connected and not connected state! Function diagram is presented on picture. Thus:

1. Warning alarm will immediately alerting on proper motor controller and (upon request) on ER Alarm Monitoring System when motor is not connected yet (alarming while motor running – as well).
2. Motor with deadly low insulation will be blocked for start !
So, Monitor prevents damage on motor with low insulation !
3. Since each starter is equipped with monitor (in starter, or separate board) the faultfinding is very simple and fast!

Above described could be related to power cable monitoring.

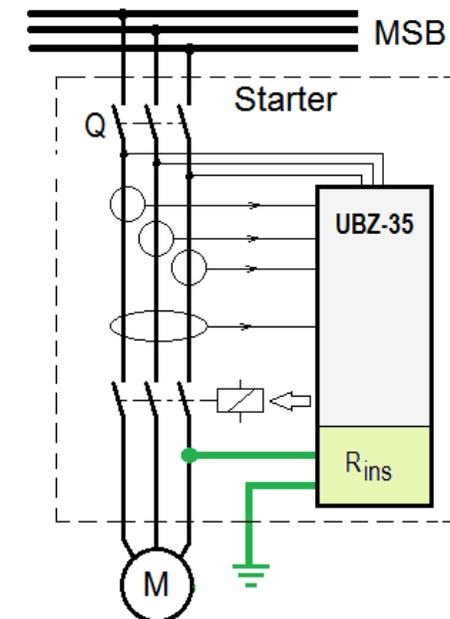
2. POWER LINE MONITORING

2.1 LACK OF PHASE PROTECTION

For a three phase asynchronous motors the two phase mode is rather dangerous. Stator current is extremely high. Thermal protection relay will activate, but due to rather simple mechanical structure of thermal relay the motor burning will occur earlier when thermal relay activated. In case thermal relay defect /sticking the motor will definitely burn.

SEAHARMONY Monitor's Over-current protection is based on contactless (reliable) manner of current measurement - current reading is performed by current transformers. Any mechanical components – missing, ambient influence (temperature, dirt etc) – eliminated.

The trip action, timing is processing by electronics. So, over-current protection function rate is rather high !



N.B. Such a protection is very effective in case one phase lack on cable, which feeding the ER Fans. Mainly ER fans are located in duct pipe. In case cable defect and defected thermal relay the fan motor will burn.

Even if the spare motor is presented onboard the replacement will take long time! ER Ventilation is very imported for ME Scavenging Air.

The SEAHARMONY Motor protecting device provide immediate motors disconnection, which eliminate motor overheating, burning probability.

2.2 VOLTAGE FREQUENCY MONITORING.

Voltage and Frequency performance of e-motor feed line is very important aspects for normal work of e-motor. Deep low value of line frequency could result in insufficient torque of e- motor. Same is related to low supply voltage.

3. MOTOR OVERLOAD PROTECTION

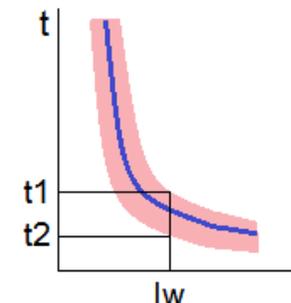
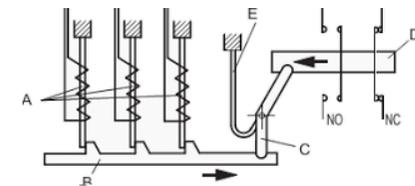
3.1 IMPERFECTION OF CONTEMPORARY THERMAL RELAYS

All contemporary starters contain so called thermal relay (current relays) which trip the motor in case of overload ($1.1-1.2 I_n$). Though the application is very important the construction of relay still is not excellent.

- All measuring / set setting elements are mechanical, so set accuracy (scale) is raw.
- Trip action mechanisms parts are miniature levers, springs etc. As per experience after some term of ordinary thermal service their function, reliability decreases due to ambient influence (temperature, humidity etc)

- Since the working principle is based on heating of bi-metallic plates the high ambient temperature could result in motor trip not on nominal current. Repeated start is available after thermal relay cool-down. In case such a failure took place on essential consumers (motors) this aspect is rather important.

- Bi-metallic current sensitive plates during motor run are little preheated.



After motor stoppage – cooled down. Such a “mode” results in sensitive elements fatigue wear and, in turn, thermal relay working characteristic slipping (t1, t2...)

3.2 SEAHARMONY MOTOR MONITORING OVERCURRENT PROTECTION - ADVANTAGES

SEAHARMONY Monitor also contains motor overload (over-current) protection. The working current measurement is provided by Current Transformers. i.e. any mechanical part missing, the measurement and threshold action is obtained by electronics processing. Thus, no any ambient influence, parameters, timing “false shifting” will occur. The setting of current threshold value, activation timing is by digital value on monitor’s display. So, protection function accuracy is very high !



4. EL. MOTOR RUNNING HOURS COUNTING

The bearing replacement in time (on defined replacement term) is vital aspect of motors maintenance. Modern starter are equipped with r/h counters. But, mainly, they are mechanical delicate devices, predisposed to damage (experience).

Monthly records should be provided by crew with further logging. But as per experience such an accounting is insufficient. Due to either Counter damage, crew negligence (forgot, other business, etc.) the bearing replacement could not be performed in time. The matter is that some modern two shielded bearings ate not generating high noise, but shield could be released and “cut” the stator coil.

SEAHARMONY Monitor provides electronic counting of running hours, no pinions, miniature mechanical parts etc. So, counting fail is eliminated.

Monitor option is an alarm initiation, when accumulated R/H value reached programmed (set) threshold value (bearing replacement time) the proper alarm on exact motor will be initiated as a reminding !



Moreover, in case the device will be connected to the SAT communication the Run/Hrs counting could be monitored, managed ashore in Technical Department (see below).

5. MECANISMUS PROTECTION (Centrifugal Pumps, Air Compressors, other)

5.1 LOW LOAD (“DRY RUN”) PROTECTION

By mean of e-motor current measurement/analyzing the SEAHARMONY Monitoring device allows to protect not only the motor, but appropriated jointed mechanisms !!

Device has such a monitoring function as Low Load (also called “Dry Run”). The sense of protection is eliminate unloaded drive (pump, compressor, etc)! The protection /signaling function is based on motor’s working current measurement. The algorithm is so that monitors measures true current of the motor and compares with set motor’s working current value.

Values arithmetical calculation- is an electronics processing. The precise threshold value, trip/alarm timing is available.

In case working current is abnormally too low the monitor will stop the motor in set time and attendant alarm will signify abnormality on drive:

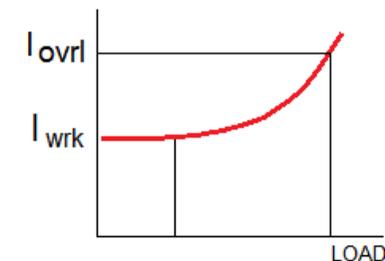
- either damage of clutch (motor-pump, compressor)
- or lack of water in pump space

“Dry run” is rather dangerous mode for the pump. It can result in pump elements damage.

Damage on clutch of Starting Air Compressor Drive will cause lack of compressed air deliver. It is vital while maneuvering when permanently starting air is required !

5.2 MECHANICAL OVERLOAD PROTECTION

SEAHARMONY MONITOR provides signaling protection function in case mechanical load increasing. Monitoring processing is so that system measures working current integrated value and compare with preset alarm value. In case driven unit

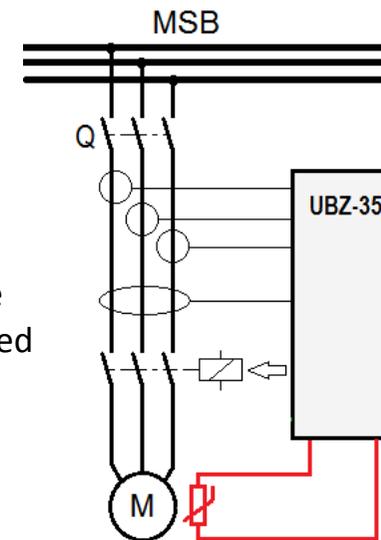


(pump etc) malfunction/ damage (bearings, impeller stacking etc) the motor's current will reach the threshold level. Signaling will be imitated.

6. MOTOR WINDING OVERHEAT MONITORING

Sometimes the ambient condition (temperature) of compartments with running motors could become rather extreme. In case the vessel will enter the very hot sealing area some ER Compartments ambient temperature could reach dangerous value. Such a mode is very undesirable for e -motor stator windings.

SEAHARMONY Monitor is designed to monitor the motor's winding temperature. The built-in thermistors (temperature sensors) in motor stator could be connected to proper analog input channel of SEAHARMONY Monitor (see Picture). In case extreme room temperature increasing the monitor will initiate an alarm. Watch personnel, warned in time can provide proper measures to reduce the room temperature or start up the st. by motor. By mean of this the motor damage will be avoided.



7. SEAHARMONY Motor Protection unit FINANCIAL BENEFITS

The above described Protecting function provides the effective financial benefit of ship's electrical equipment service.

- Insulation resistance,
- Two phase, Voltage, Frequency protection
- Overload (Mechanical Overload) protection function

These above functions will eliminate the motor burning. Average price of big e-motor is abt **48000 usd** or more !

- Electronic r/h counting
- Option to transfer the r/h to technical managing office

These functions allows to provide motor maintenance in time! Moreover, monthly, quarterly etc analyzing of accumulated running hours of different drives will indicate discrepancies on entire systems setting, driven mechanisms (pumps, compressors) components wearing! Proper technical advice from Technical department will eliminate the mechanisms damage.

Also- by mean of analyzing drives R/H the correct parts supply could be obtained. In consideration of year term service the expenses saving could be up to **10000 usd**.

Another very important aspect is the SHIP'S SYSTEMS UNINTERRUPTIBLE FUNCTIONING.

In consideration of very essential system such a LT, HT Water Cooling, ME system the financial benefits will be very high.

Let's consider situation of contemporary system, for example ME LO system. All modern pump systems (LT, HT Water, ME, etc) contain two pumps (motors) – main and st. by. One of the motor – damaged, out of service and system functioning is provided by one motor. New motor supply- expecting. In case remaining motor fail or trip due to thermal relay malfunction (or other) the whole system (ME LO deliver, for instance) will be unable. ME will shut down. In case the vessel is birthing and crush (peer touch) will take place the expenses loss estimation value will vary nearly **hundred thousands!!**

Thus, SEAHARMONY Motor protection devices provide the SAFETY FEATURES of ER system!

Installation of SEAHARMONY Electro Motor Monitoring Protecting Devices is highly preferable!

8. EL.MOTORS (Mechanisms) E-NET MONITORING

One of Important Option of the SEAHARMONY Monitor is possibility to connection to the Ship's Network by Satcom system !

By mean of this the monitoring of electrical motors could be transferred to technical departure ashore ! Ship's electrical drives modes, running hours, failure etc could be monitored, analyzed by superintendants. Proper conclusions, advices will make ship's equipment servicing most effective and save.

