COMM – COMPONENT OPERATION MAINTENANCE MANUAL

NIK5.3#5 IN-Kind – Project
Test Package for Linear Motion Technology

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Content

Logistics

Packaging

For transport within Europe, the test items should be packaged in strong boxes of common construction. This depend on their dimensions. From a gross weight of 5 kilograms, the boxes have to be strapped with steel or polyester straps. From 30 to 1000 kilograms gross weight there have to be placed nonreturnable- or euro pallets under the boxes. Above 1000 kg special pallets must be used which have the required load capacity. For bigger items, which cannot be packed in common boxes, pallets or suitable wooden constructions have to be fabricated to allow handling with forklifts. Particularly four-way flat pallets (euro palette) made of wood are to be used. The packaging is selected as economically and space-saving as possible. Basically, the packaging must be designed so that the packaged test items and the packaging can be transported and stored without damage. Furthermore, the packaging have to withstand several shocks during transport. Small parts (screws, nuts, washers, etc.) should be packed in plastic bags. During packaging, special attention must be paid to assembly-related compilation. For filling material or protection padding paper, air bags, bubble wrap, foil and foam material should be used. The logistics department of Forschungszentrum Jülich will provide correct and professional packaging.

Storage

Storage in temperate buildings (+10 °C to +35 °C).

Transportation

A truck will execute the transport. The truck driver should offer good command of English, which corresponds to the specification of the ESS. The truck body has to be designed in that way, that at full load capacity and under the influence of dynamic driving acceleration, the force from the load can be fully absorbed by the side, front and rear load space limitations and by the load-bearing capacity of soil. To protect the load against tipping and falling rejection beams have to be attached. A form-fit loading is important and the safest method of safe transport loading. Because of that, it is to avoid empty spaces and to use the capacity of the side walls of the truck trailer. In the case of unavoidable loading gaps, it is necessary to attach pads or airbags as spacers to form the connection. Furthermore, edge protection has to be provided for boxes and flat parts. For stacked loads (such as wooden crates), anti-slip pads should be used.

Handling

In principle, all products have to be transported, stored and loaded in accordance with the handling symbols affixed to the boxes (Example: vertical loading of flat parts and electrical control cabinets). The careful use of floor conveyors (forklifts, pallet trucks) is a requirement for damage-free transport. By jutting forks, for example, close-by stored products are especially endangered.

Test equipment

Expected preventive maintenance activities

Since linear motors do not generate the translative movement with the aid of spindles or belts and thus there is a smaller number of mechanical parts, this reduces the maintenance effort and reduces the system costs. Nevertheless, there are things that should be taken care of as a preventive maintenance. For maintenance, two types of maintenance programs will be described below, including expected maintenance jobs.

Reactive maintenance

Reactive maintenance allows the equipment to run until failure. Then the failed equipment is repaired or replaced. Under reactive maintenance, temporary repairs may be made in order to return equipment to operation, with permanent repairs put off until a later time. Reactive maintenance allows a plant to minimize the amount maintenance manpower and money spent to keep equipment running. However, the disadvantages of this approach include unpredictable and fluctuating capabilities, higher levels of out-of-tolerance and scrap output, and increased overall maintenance costs to repair catastrophic failures.

Proactive maintenance

Proactive maintenance is a strategy for maintenance whereby breakdowns are avoided through activities that monitor equipment deterioration and undertake minor repairs to restore equipment to proper condition. These activities, including preventive and predictive maintenance, reduce the probability of unexpected equipment failures.

Preventive maintenance is often referred to as use-based maintenance. It is comprised of maintenance activities that are undertaken after a specified period of time or amount of machine use. This type of maintenance relies on the estimated probability that the equipment will fail in the specified interval. The work undertaken may include equipment lubrication, parts replacement, cleaning and adjustment. The test equipment may also be inspected for signs of deterioration during preventive maintenance work. The benefits of preventive maintenance are reduced probability of equipment breakdowns and extension of equipment life. The disadvantage of preventive maintenance is the need to interrupt operation at scheduled intervals to perform the work.

Predictive maintenance is often referred to as condition-based maintenance. Specifically, maintenance is initiated in response to a specific equipment condition. Under predictive maintenance, diagnostic equipment is used to measure the physical condition of equipment such as temperature, vibration, noise, lubrication and corrosion. When one of these indicators reaches a specified level, work is undertaken to restore the equipment to proper condition. This means that equipment is taken out of service only when direct evidence exists that deterioration has taken place. Predictive maintenance is premised on the same principle as preventive maintenance although it employs a different criterion for determining the need for specific maintenance activities. As with preventive maintenance, predictive maintenance reduces the probability of equipment breakdowns. The additional benefit comes from the need to perform maintenance only when the need is imminent, not after the passage of a specified period of time.

MTBF

In addition, the determination of the mean time between failures (MTBF) can be helpfull to minimize breakdowns of the test equipment. MTBF is the predicted elapsed time between inherent failures of a mechanical or electronic system, during normal system operation. MTBF can be calculated as the arithmetic mean (average) time between failures of a system. The term is used for repairable systems, while mean time to failure (MTTF) denotes the expected time to failure for a non-repairable system. The definition of MTBF depends on the definition of what is considered a failure. For complex, repairable systems, failures are considered to be those out of design conditions which place the system out of service and into a state for repair. Failures which occur that can be left or maintained in an unrepaired condition, and do not place the system out of service, are not considered failures under this definition. The higher the MTBF, the longer a system is likely to work before failing.

Calculation: $MTBF = 1 / \lambda$

The units used are typically hours or lifecycles. λ describes the failure rate.