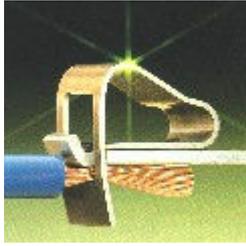


WAGO Technical Article: How to Improve Electrical Systems Reliability



Independent studies show that connectors are the direct or indirect source of 35% - 50% of electrical system failures. So one easy way to improve system reliability is to use highly reliable terminal blocks.

Problems of Screw-Type Terminals

Many people think that terminal blocks are trivial parts, but senior engineers may find this true story familiar :

System failed at 3:00am and all four engineers of a team were summoned to plant to fix the problem. After several hours, the cause was found to be a loose screw in a terminal block, though all screws were regularly maintained.

This is in fact a very common problem of traditional screw-type terminal block, because it relies on the copper wire's reaction force to provide friction between the bolt and nut. **Since copper is ductile, it settles when subject to vibration, current / temperature cycling, and expansion / contraction, resulting in loss of friction and loose screw.** The process takes a few months to three years. Even if maintenance people re-tighten the screw regularly, the following **uncertainties** still exist :

1. *How frequent should terminals be re-tightened to **guarantee** 100% reliability? (3 months? 6 months?)*
2. *How many times can it be re-tightened before the screw thread or plastic housing fractures (or close to fracture)?*
3. *When checking the wire, will the worker make it loose (which is otherwise tight) without knowing it?*
4. *How tight is enough to withstand a given vibration, while preventing screw fracture or wire damage?
(Rely on experience of workers?)*
5. *How to make sure that **each** of the thousands terminals is re-tightened?
(Rely on sense of responsibility of workers?)*

If your company is ISO9000 certified, then you should make sure that the torque applied should meet manufacturer's recommendation. However,

6. *Will workers really provide the correct (and different) torque for different wire sizes? How do they know? How do **you** know?*

A rather famous manufacturer suggests that a torque 50% higher than IEC 947-1 standard should be used for their terminals, but if the torque exceeds that by another 30%, the screw will fracture. Even **if** workers can applied **exactly** a torque which is 150% - 180% of the IEC standard, they still do not know what vibration it can withstand, and for how long (e.g. Is 10G at 1KHz okay for 3 months?)

WAGO Screw-less Terminal Block

Only WAGO Cage-Clamp Screw-less terminals are maintenance free and 100% reliable.

WAGO, founded in Germany in 1951, invented Cage-Clamp screwless terminal block in 1977. Because of its vibration proof characteristics, the patented Cage-Clamp terminals have been chosen by various heavy and light industries, numerous train and metro systems all over the world, and even **by NASA in rocket launching platform.** Association of American Railroads even modified their specification to accept WAGO Cage-Clamp terminal blocks.

Unlike screw-type terminal, WAGO terminal guarantees a **perfect contact every time, regardless of the skill and care of the worker** because it has only two states (connected, disconnected). There is **no grey area** (e.g. 95% tight) to worry about.

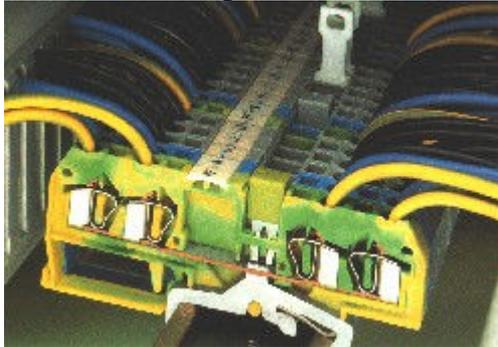
The high tech stainless steel Cage-Clamp, because of its shape and forming process, can **automatically** exert a contact pressure that is **proportional to the size of the cable** (per IEC 947-7-1, EN60947-7-1 etc.) So a **single part can be used for the entire system's wiring** (e.g. 4mm²



terminal can accept 0.08-4mm² wires), making system clean and tidy. Better yet, when a T-off wire has to be added and there is no space for extra terminals, simply replace the 2-point terminal with our 3-point or 4-point terminals.

Other benefits of WAGO Cage-Clamp :

1. Vibration proof* (109G at 2KHz, UL, VDE0611 etc. approval)
2. Temperature cycling, current cycling, strand setting etc. has no effect on contact
3. Independent of workers' workmanship and care
4. Maintenance free. Just fit and forget.
5. Contact pressure proportional to cable size
6. Front connection provides good view for wire insertion
7. Wide range of products and accessories including EEx e, EEx i series
8. Suitable for all types of wires (solid, stranded, fine strand, wire pin etc.)
9. Approvals from ~20 countries (UL, KEMA, CSA, VDE). ISO9002 quality.
10. Patented design



*: *Can your current terminal supplier provide vibration test results or approval?*

WAGO has the widest range of products in the world, including 1-to-1, 1-to-2 and 1-to-3 terminals, fuse holder (with blown fuse indicator), disconnect terminals, plug-in electronic modules (e.g. AC/DC relays, surge suppressor, optocouplers etc.), headers and connectors, push-wire (for lighting) and PCB series.

National Concord Engineering Ltd. (NCE) will be glad to answer any questions you may have on WAGO products. We are also happy to present and demonstrate at your office. The following information or samples are available upon request :

- Technical manual
- Short-form Catalog
- Master Catalog (670 pages full color)
- Worldwide Job References (incl. China) in railways industry

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