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Perancangan dan Analisis Mekanisme Penjepit Kabel Grounding Berbasis Spring-Loaded Pivot Clamp Pada Peralatan ESD Protected Area
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Pengendalian *electrostatic discharge* (ESD) pada area produksi industri elektronik membutuhkan koneksi *grounding* yang stabil. Berdasarkan data *compliance verification* pada peralatan ESD *Protected Area* PT XYZ periode Juni sampai Desember 2025, terdapat 20 temuan *Non Good*, dengan 13 temuan berkaitan dengan koneksi *grounding*, berupa kabel terlepas, kabel terlepas dari skun, dan skun yang tidak kencang. Penelitian ini bertujuan merancang mekanisme penjepit kabel *grounding* berbasis *spring-loaded pivot clamp* sebagai alternatif sambungan *grounding* yang mampu menjepit inti tembaga sekaligus menahan tarikan kabel. Mekanisme dirancang untuk inti tembaga berdiameter 2 mm dan diaplikasikan pada *aluminium profile* berukuran 40 × 40 mm. Perancangan dilakukan melalui pemodelan mekanisme dan analisis mekanis struktur statis menggunakan metode elemen hingga pada ANSYS. Evaluasi rancangan dilakukan dengan membandingkan tiga material, yaitu *copper* C11000, *brass* C36000, dan *aluminium alloy* 6061-T6, berdasarkan tegangan ekuivalen, *total deformation*, dan *safety factor*. Hasil perhitungan menunjukkan pegas dengan konstanta 19,6 N/mm dan defleksi 3 mm menghasilkan gaya penjepitan sebesar 58,8 N, sedangkan gaya penahanan tarik teoritis mencapai 300 N untuk memenuhi gaya tarik desain sebesar 200 N. Berdasarkan hasil evaluasi, *aluminium alloy* 6061-T6 dipilih sebagai material yang paling sesuai karena memenuhi kriteria struktural dan memiliki konduktivitas listrik yang memadai. Pada hasil analisis material tersebut diperoleh tegangan ekuivalen maksimum sebesar 72,043 MPa, *total deformation* maksimum sebesar 0,21322 mm, dan *minimum safety factor* sebesar 2,9247. Hasil tersebut menunjukkan bahwa rancangan mekanisme penjepit kabel *grounding* memenuhi kriteria mekanis yang ditetapkan dan dapat menjadi alternatif untuk mengatasi permasalahan sambungan *grounding* pada peralatan ESD *Protected Area*.

Kata kunci: *grounding cable*, ESD *Protected Area*, *spring-loaded pivot clamp*, gaya jepit, metode elemen hingga.

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ABSTRACT

Electrostatic discharge (ESD) control in electronics manufacturing production areas requires stable grounding connections. Based on compliance verification data on ESD Protected Area equipment at PT XYZ from June to December 2025, there were 20 Non Good findings, of which 13 were related to grounding connections, including detached cables, cables detached from cable lugs, and loose cable lugs. This study aims to design a grounding cable clamping mechanism based on a spring-loaded pivot clamp as an alternative grounding connection capable of clamping the copper core while resisting cable pulling forces. The mechanism is designed for a copper core with a diameter of 2 mm and is intended to be installed on a 40 × 40 mm aluminium profile. The design process was carried out through mechanism modeling and static structural mechanical analysis using the finite element method in ANSYS. The design was evaluated by comparing three materials, namely copper C11000, brass C36000, and aluminium alloy 6061-T6, based on equivalent stress, total deformation, and safety factor. The calculation results show that a spring with a stiffness of 19.6 N/mm and a deflection of 3 mm produces a clamping force of 58.8 N, while the theoretical cable holding force reaches 300 N to meet the design pulling force of 200 N. Based on the evaluation results, aluminium alloy 6061-T6 was selected as the most suitable material because it meets the structural criteria and has adequate electrical conductivity. The analysis results for this material showed a maximum equivalent stress of 72.043 MPa, a maximum total deformation of 0.21322 mm, and a minimum safety factor of 2.9247. These results indicate that the designed grounding cable clamping mechanism meets the established mechanical criteria and can serve as an alternative to address grounding connection problems in ESD Protected Area equipment.

Keywords: *grounding cable, ESD Protected Area, spring-loaded pivot clamp, clamping force, finite elemen analysis.*