

ABSTRAK

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Judul Laporan Akhir : Rancang Bangun Dapur Cor Listrik Aluminium
dengan Kapasitas 3 Kg (Biaya Produksi)

(2025: xiv + 53 Halaman, 12 Gambar, 4 Tabel + 6 Lampiran)

Permintaan akan peralatan peleburan aluminium yang efisien, ekonomis, dan ramah lingkungan semakin meningkat seiring berkembangnya industri kecil dan menengah. Aluminium merupakan logam non-ferrous yang memiliki titik lebur relatif rendah ($\pm 660\text{ }^{\circ}\text{C}$) sehingga dapat didaur ulang dengan peralatan sederhana. Namun, harga dapur cor komersial yang tinggi seringkali menjadi kendala bagi pelaku usaha berskala kecil. Oleh karena itu, laporan akhir ini bertujuan untuk merancang dan membangun dapur cor listrik aluminium dengan kapasitas 3 kg yang sederhana, mudah dioperasikan, serta memiliki biaya produksi terjangkau. Metode perancangan dilakukan secara sistematis melalui tahap identifikasi kebutuhan, perhitungan kebutuhan energi panas, desain elemen pemanas berbahan kawat nikelin, pemilihan cawan pelebur dari pipa besi, penerapan isolasi berupa bata tahan api dan fire blanket, hingga pembuatan rangka baja untuk menopang struktur tungku. Sistem kontrol suhu menggunakan hope TCG dengan sensor termokopel tipe K, serta dilengkapi dengan MCB dan kontaktor untuk keamanan operasional. Hasil perhitungan menunjukkan bahwa peleburan aluminium seberat 3 kg memerlukan energi panas total sekitar 3.215,7 kJ dengan waktu peleburan $\pm 52,8$ menit. Efisiensi termal alat diperkirakan mencapai 92%, yang menandakan konversi energi listrik ke energi panas cukup efektif. Dari sisi ekonomi, biaya produksi alat tercatat sebesar Rp3.320.233,-, dengan harga jual Rp3.818.268,- sehingga memberikan keuntungan 15%. Alat yang dihasilkan sesuai spesifikasi desain, relatif portable, mudah digunakan, dan layak diterapkan dalam peleburan skala kecil. Dengan demikian, dapur cor listrik berkapasitas 3 kg ini dapat menjadi alternatif solusi bagi pelaku industri kecil maupun bengkel pengecoran sederhana, khususnya dalam upaya meningkatkan efisiensi energi, menekan biaya produksi, dan mendukung pemanfaatan kembali aluminium secara lebih berkelanjutan.

Kata Kunci: dapur cor listrik, aluminium, elemen pemanas, biaya produksi

ABSTRACT

Design and Construction of a 3 kg Capacity Electric Aluminium Casting Furnace (Cost Production)

(2025: xiv + 53 pp. + 16 Figures + 6 Tables + 6 Attachments)

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The demand for efficient, economical, and environmentally friendly aluminium melting equipment continues to grow, particularly in small and medium-scale industries. Aluminium, as a non-ferrous metal with a relatively low melting point ($\pm 660\text{ }^{\circ}\text{C}$), can be recycled using simple equipment. However, the high cost of commercial furnaces often becomes a limitation for small-scale operators. Therefore, this final project aims to design and construct a 3 kg capacity electric aluminium casting furnace that is simple, easy to operate, and cost-effective. The design method was carried out systematically through several stages, including identifying operational requirements, calculating the required heat energy, designing the heating element using nichrome wire, selecting a crucible made of steel pipe, applying firebrick and fire blanket insulation, and building a steel frame to support the furnace structure. The temperature control system employed a PID TCG controller with a type K thermocouple sensor, supported by an MCB and contactor to ensure safe operation. The calculation results showed that melting 3 kg of aluminium requires a total heat energy of approximately 3,215.7 kJ with a melting time of about 52.8 minutes. The furnace is estimated to achieve a thermal efficiency of 92%, indicating that the conversion of electrical energy into useful heat is highly effective. In terms of economics, the total production cost was calculated at Rp3.320.233,-, while the selling price was set at Rp3.818.268, providing a 15% profit margin. The furnace was successfully built according to design specifications, portable, user-friendly, and feasible for small-scale melting applications. In conclusion, this 3 kg electric aluminium casting furnace can serve as an alternative solution for small industries and workshop-scale casting, particularly in improving energy efficiency, reducing production costs, and supporting sustainable aluminium recycling practices.

Keywords: electric casting furnaces, aluminum, heating element, production costs