



Observatoire Europe-Afrique 2030

Data Sheet « Value Chain»

Data Sheet n°10

Electric Locomotive

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1. Value Chain of an electric locomotive manufacturing

The manufacture of a locomotive or self-propelled trainset involves a complex organization coordinated between several plants, involving a prime contractor and numerous subcontractors and partners. Each plant specializes in the manufacture of one or more modules, with one of them performing the final assembly. The process requires little assembly-line work and few robots (except for painting).

It comprises 4 phases:

Manufacture of the structure (the "body") by metal treatment, welding, straightening and finally painting and shot-blasting.

Manufacture of functionally homogeneous modules

- Motors: AC motors have become the standard for modern locomotives. A standard electric locomotive motor can cost between \$3 and \$8 million.
- Wheels
- Axles
- Bogies
- On-board electronics: Transformers, rectifiers/thyristors, inverters, compressors, capacitors, inverters.....
- Brakes (air or disc)
- Traction boxes
- Pantographs
- Driver's cabin
- Upholstery (seats....)

Assembly

- Wiring (1 month's production).
- Assembly of wired products into sub-assemblies: roofs, chassis, door frames and cabins (15 days' production).
- Assembly of sub-assemblies (one day).
- Cladding, seats, windows (15 manufacturing days).
- Bogie mounting (3 manufacturing days).

Tests

Dynamic running sessions to check behavior on a test track (6 weeks of testing).

The cost of manufacturing an electric locomotive ranges from \$2 to \$6 million, or even \$10 million, depending on the type and size of the locomotive.

2. Possible investment schemes

Given the technological complexity of most of the modules making up an electric locomotive, there are several possible options for investment in Africa, depending on the investor's financial resources and level of know-how:

- The "maximum" approach, for an investor having substantial financial resources, consists in setting up a galaxy of companies (prime contractor, tier 1 and 2 subcontractors) capable of manufacturing at least the body and several modules, as well as assembly. This presupposes a very high initial investment and considerable know-how input.

- The "progressive" approach consists in concentrating the initial investment on :

- o the manufacture of the body

- o the manufacture of one or more modules of "medium" technological complexity (wheels, axles, transformers, etc.), with the other modules being purchased from suppliers, as well as Assembly and tests.

- The "minimal" approach is limited to assembly and testing operations, all modules being purchased from suppliers.

3. Sources of information

<https://traintrackshq.com/fr/comment-fonctionnent-les-trains/>

<https://diffusonslascience.fr/question-combien-coute-un-wagon/>

<https://microtexindia.com/fr/locomotive/>

<https://www.primante3d.com/am-ferroviaire-12052022/>

<https://www.rtl.fr/actu/debats-societe/comment-sont-fabriques-les-trains-de-nos-jours-7787531606>

<https://www.leparisien.fr/economie/des-trains-alstom-made-in-china-09-11-2016-6305436.php>

<https://microtexindia.com/fr/locomotive/>

https://french.alibaba.com/Popular/CN_railway-wheel-920mm-Trade.html

www.traintrackshq.com

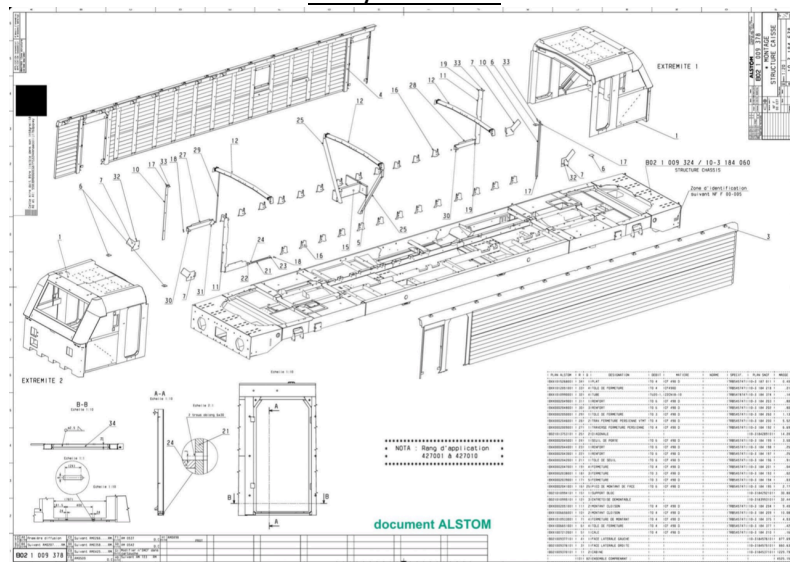
<https://docrail.fr/bb-27000-et-37000/>

4. Annex : Photographs of the BB-27000 freight locomotive (manufactured by Alstom)

Overall view



Body structure



Driver's cabin



Internal view of the body



Power management processors



Bogie



Main Transformer



Traction Engine

