

**GUIDANCE FOR ELECTROMECHANICAL DESIGNS
OF NEW PUMPING STATIONS IN NATIONAL WATER
SUPPLY AND DRAINAGE BOARD**

H D S Priyathilaka

(128782 E)

Degree of Master of Science in Electrical Installations

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree
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DECLARATION OF THE CANDIDATE & SUPERVISORS

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(Prof. J P Karunadasa)

ABSTRACT

National Water Supply and Drainage Board is the largest individual customer of Ceylon Electricity Board. It has been observed that the cost of electricity and the capital cost of investment can be reduced appreciably by adapting better electromechanical design methodologies for new pumping stations. Current practice is that foreign contractors do the design and construction on secured funds with their own equipment and procedures without much of a concern of the operational cost in the long terms. This project is to identify drawbacks in the existing pumping stations and drafting design guidelines for the new pumping stations to achieve lower capital cost and operational cost. Some of the key areas considered in this thesis are given below.

Collect data such as power rating, pump type, pump operating point and the number of motors available to check whether they operate at the best efficient point and to compare whether the design requirements are fulfilled.

Main objective of the research is to develop a software guided systematic approach to electromechanical designs of new pumping stations in the NWSDB taking cost, performance, service, and maintenance factors in to consideration.

The total flow rate, static head of pumping system, number of duty pumps and standby pumps are the basic input to this software. Details of piping and accessories are to be provided additionally to calculate the total head and NPSH availability. Web base software provided by the pump manufacturers are used to select most efficient pumps for the particular application. Power transformers, standby generators, power cables and circuit breakers are selected with the use of this software. Additionally, operational cost calculation is also carried out in order to rank and select the optimum combination of pumps for cost optimization.

The web base software has been developed to analyze the existing pumping systems and to design new pumping stations while maintaining lower capital cost and operational cost.

Key words:

Pumping stations, Cost optimization, Design guidelines, NWSDB

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LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---------------------|--|
| CB | Circuit Breaker |
| CEB | Ceylon Electricity Board |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronic Engineers |
| kWh | kilo Watt hour |
| LKR | Lanka Rupees |
| LV | Low Voltage |
| MV | Medium Voltage |
| NPSH | Net Positive Suction Head |
| N RW | None Revenue Water |
| NWS&DB | National Water Supply and Drainage Board |
| OC | Over Current |
| O&M | Operation & maintenance |
| SCADA | Supervisory Control and Data Acquisition |
| VFD | Variable Frequency Drive |

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