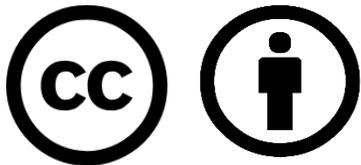


Load Lists

Revision of 20 February 2026

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<http://doerry.org/norbert/MarineElectricalPowerSystems/index.htm>

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Essential Questions

What is a Load List and what is it used for?

Understand

How does one develop a load list?

Apply

How does one determine which data must be gathered?

Apply

How does one gather and manage the data?

Apply

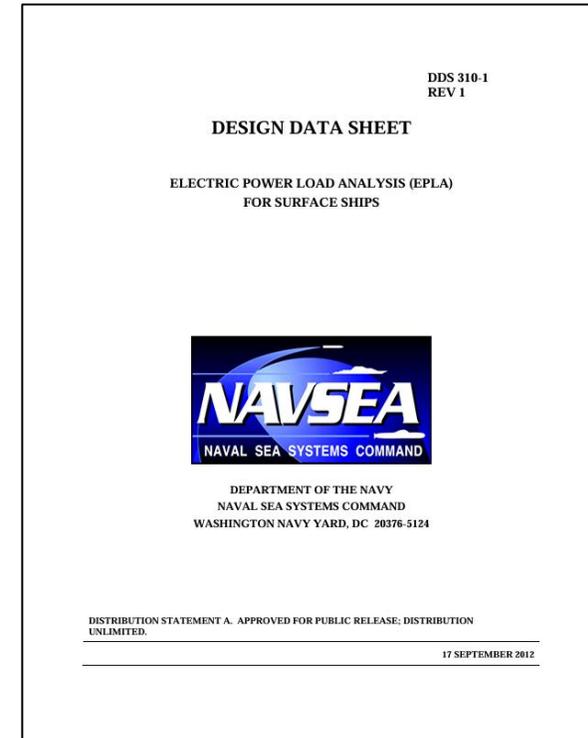
How does one adjust a load list from a parent design?

Apply

Introduction

Load Lists

- Tracks all electrical loads onboard the ship
 - Configuration managed.
 - Includes characteristics of the electrical loads necessary to create load models.
- Should be complete
 - All loads should be represented by an entry in the load list.
 - Known loads with mostly known characteristics incorporated directly.
 - Loads with significant uncertainty modeled as proxy loads.



T9070-A3-DPC-010/310-1
(DPC 310-1)
(formerly DDS 310-1)

Proxy Loads

- Represent a load or group of loads
 - In early stages of design, actual equipment hasn't been determined yet.
 - Proxies serve as placeholders for equipment that hasn't been defined.
 - Characteristics based on parametric equations, similar equipment, or scaled equipment from other ships.
 - Use an appropriate scaling relationship if scaling from another ship
 - If representing a group of loads, all the loads should connect to the power system at the same points.
 - Commonly done for electrical lighting and electric heaters
- Proxy load definition
 - Should clearly state what loads are part of the proxy load.
 - Where possible, should identify estimated characteristics of constituent loads as well as the total proxy load roll-up.
- Proxy load evolution
 - As the design matures, constituent loads of the proxy load are removed from the proxy load and become defined loads in the load list.
 - Proxy load characteristics are adjusted by removing the impact of the loads removed from the proxy load on the total proxy load roll-up.
 - In detail design, as equipment becomes defined, all proxy loads should be replaced with defined loads.

Sources of data

- Master equipment list
- Mission systems description and one line diagram
- Electrical plant description and one line diagram
- Distributed system descriptions and one-line diagrams
- General/machinery arrangements
- Product model (if it exists)
- Discussions with system designers (if possible)
- EPLAs of similar ships (if available)

Data Elements

- Nomenclature
- Product breakdown structure identifier
- Location on the ship (zone and/or compartment)
- Point(s) of connection to the power system (power panel, load center, switchboard).
- Identification Plate (nameplate) rating (include units)
- Connected load (kW and kVAR)
- Peak load (kW and kVAR)
- Power type (voltage, number of phases, frequency)
- Load behavior
- Use during different ship operating conditions
- Correlation with other loads
- In-rush current demand (if applicable)
- Temperature dependence (if any)
- Tolerance to power interruptions (for QOS analysis – if applicable)
- Load shed priority (mission priority)
- References

Data Elements (continued)

- Nomenclature
 - Descriptive name of a load
 - Identical equipment should have the same base name followed by a unique identifier (Diesel Generator Set 1, Diesel Generator Set 2)
- Product breakdown structure identifier
 - Used to group loads in an understandable manner (i.e. SWBS)
- Location on the ship (zone and/or compartment)
 - Used to ensure the connection to the power system makes sense
- Point(s) of connection to the power system (power panel, load center, switchboard).
 - Early on, may only know the switchboard connection
 - As the power distribution system is defined, the connection should be to the appropriate load center (and power panel)
 - Loads with multiple points of connection should indicate the normal and alternate points of connection.

Product breakdown structure in IEEE Std 45.1

Group	System/Equipment
100	Propulsion
200	Batteries and battery chargers
300	Power conversion equipment
400	Lighting
500	Electronics
600	Navigation systems
700	Auxiliaries
800	Heating ventilation and air conditioning systems
900	Deck machinery
1000	Food services
1100	Workshop/Laundry equipment

Data Elements (continued)

- Identification Plate (nameplate) rating (include units)
 - Nameplate may have rated load in amps or mechanical hp
- Connected load (kW and kVAR)
 - Nameplate rating converted to electrical real and reactive power (for ac systems)
- Peak load (kW and kVAR)
 - The maximum load expected in operation
 - Often less than the connected load
 - For example: motors driving a pump
- Power type (voltage, number of phases, frequency)



Data Elements (continued)

- Load behavior
 - Constant: When on, load does not deviate substantially from its average value.
 - Multi-mode: When on, load has multiple modes, but the load does not change much while in a particular mode.
 - Pulsed: When on, load is a pulsed load.
 - Cyclic: When on, load is at its peak load for approximately a specified time, then off for approximately another specified time.
 - Other: When on, load characteristics are other than one of the above options.
 - Unknown: Load characteristics are unknown. More data gathering is required to develop a load model.
- Use during different ship operating conditions
 - For each of the operating conditions, an indicator (typically TRUE, FALSE, GROUP, or UNKNOWN) if the load is on.
 - If GROUP, part of a group of loads, see Correlation with Other Loads.
 - If UNKNOWN, additional data gathering is required before the load is modeled.



Electric Heater
USS Wisconsin BB-64
Photo by Norbert Doerry

Data Elements (continued)

- Correlation with other loads
 - Provide information with respect to how this load relates to other loads.
 - Possibly separately define groups of loads.
 - This field lists groups that the load is a member of
 - Rules for use of loads within a group part of group definition
- In-rush current demand (if applicable)
 - Amount of in-rush current.
 - Alternately, a multiplier for the rated current.
 - Should also have an indicator that the load has an in-rush current, but its magnitude is not known.



Boat Davit Winch
USS Wisconsin BB-64
Photo by Norbert Doerry

Data Elements (continued)

- Temperature dependence (if any)
 - Indicates if load depends on the ambient condition
 - TRUE, FALSE, UNKNOWN
 - Electric heaters typically temperature dependent
- Tolerance to power interruptions
 - Longest power disruption that can be tolerated
 - Example levels
 - 0 ms
 - 10 ms
 - 80 ms
 - 0.5 ms
 - 2 s
 - 2 m
 - 5 m
 - Unknown
 - Used to determine Quality of Service category



Electric Heater
USS Wisconsin BB-64
Photo by Norbert Doerry

Data Elements (continued)

- Load shed priority (mission priority)
 - At a minimum should indicate if an emergency load
 - Depends on mission priority load shed approach
 - Traditional naval combatant approach
 - Vital
 - Semi-vital
 - Non-vital
 - Dynamic mission priority load shedding enables defining different priority levels for different operational conditions
- References
 - Each data element should reference one or more data sources
 - Method of obtaining the reference (such as hypertext link) should be provided



Harpoon Missiles
USS Wisconsin BB-64
Photo by Norbert Doerry

Managing the load list

- Early in concept design
 - May be managed as part of a ship synthesis software tool
 - Extensive use of proxy loads
- As design matures
 - Spreadsheets may be employed
 - Concentrate on obtaining credible data for 50 to 100 largest loads
 - Usually accounts for 60% to 80% of the ship's total load
- In preliminary design
 - Databases often used
 - Usually requires at least one dedicated engineer
 - Track down missing data
 - Considerable interaction with potential vendors
 - Considerable interaction with design team
 - Replace proxy loads with actual loads where possible
 - Develop credible estimates