Transformer Support-Base: Design & Analysis

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Project Background

ABB is a large global manufacturer of power systems and electronic products. Many of their enterprise products are subjected to varying weights, depending on unit type and size. There is a need at ABB for a set of methods and standards regarding the design of support structures that can accommodate a variable range of transformer sizes.

Project Proposal to accommodate:

- **1 MVA transformer**
  - Weight: 6300-8500 lbs.
  - Dimensions: 50in W x 30in D

- **500 kVA transformer**
  - Weight: 3800 lbs.
  - Dimensions: 50in W x 22in D

- **300 kVA transformer**
  - Weight: 2500 lbs.
  - Dimensions: 32in W x 22in D

**Goals**

- Develop:
  - Scalable design standards
  - Universal parts & compatibility
  - Cost-effective design
  - Structural reliability
- Increase:
  - Finished product transportability
  - Ease of assembly
  - Product marketability

**Proposed Design**

- Parallel-Flange C-channel
- ASTM A36 Steel Members
- Extendable sectional-design
  - Scalable width & depth
  - Universal Corner & Leg Supports

**Design Benefits**

- In-house assembly; build as needed
- Stock universal parts not assemblies
- Nut & bolt assembly vs. welding
- Optional caster-wheel mobility
- Forklift and pallet-jack compatible
- Easily modified to fit changes in size
- Exceeds factor of safety 2X
- Built-in leveling device (see below)

**Project number**: MNE 524  
**Team members**: Tamrat Abebe, Hiba Aldar, Charles Wold  
**Faculty adviser**: Daren Chen, Ph.D.  
**Sponsor**: ABB

**Problem**

To accommodate moderate changes in a transformer’s dimensions, weight or configuration, requires a new custom support-base design.

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**Results & Analysis**

**Primary Material**: ASTM A36 Steel

- Tensile Yield Strength: 36.3 ksi
- Compressive Yield Strength: 22.0 ksi
- Modulus of Elasticity: 29,000 ksi
- Poisson’s Ratio: 0.260

**Test Analysis on 500kVA Base**

- Base Size: 50in W x 22in D
- Max Stress: 7.58 ksi
- Max Deflection: 0.0027 in

**Conclusions**

At double the actual load, the 500 kVA test model has a 2.9 factor of safety. The design satisfies all of the specified goals, but further testing should be done across a broader range of dimensions and loads. To reduce costs, future considerations should be given to reduce the size of the support materials as needed, versus a “one size fits all” approach.