

ME349

Engineering Design Projects

Generating Customer Requirements and Engineering Specifications and Targets

These steps with the design process are intended to give the design team a thorough understanding of the problems and to begin directing their thoughts to the generation of a large number of potential solutions to the problem. It will also develop the benchmarks by which the various design solutions may be measured. You may feel that these steps slow down the design process, but the time spent in generation of requirements, specification and targets will be returned multi-fold in terms of time spent to develop potential concepts and the quality of your eventual solution.

- 1) Generate list of your customer base. Remember that the customer base includes more than the end-use users of your product. You must also consider retailers, service persons, and the personnel of your firm including manufacturing and marketing. Almost anyone who contacts your product will have some level of customer interest.
- 2) For each group within customer base, try to determine customer requirements. Be as extensive as possible. Requirements should be in the customer's words, e.g., things like "easy to use", "compact in size". The terms should be positive, not what is wrong with an existing design. Organize the requirements by type. Use the list of types given below to help you in assembling this list. It is suggested that you store these within a spreadsheet so that it will be easier for you to associate other factors with each requirement and to sort your list.
- 3) For each of the requirements generated, assign a weight factor specifying whether you feel the requirement is something the product **MUST** have, **SHOULD** have or would **BE NICE** if included. It is common to use a 0-10 point scale where the **MUSTs** are assigned a value of 10. By weighting the requirements, you will be better able to weight your engineering requirements and eventually your concepts.

MUST requirements are often associated with standards, spatial requirements, and company requirements. Be careful in identifying **MUSTs**, not all requirements are absolutely essential.

Record these weight factors in your spreadsheet.

- 4) For each requirement, define the engineering metrics to be used. For example, a customer requirement of "light weight" may have metrics of LBS or Kilograms. Doing this will help you in defining engineering specifications.

- 5) This step will involve the general of measurable engineering specifications. This will provide us with a means of developing design concepts for our product. A critical step here is to find as many measurable engineering specifications for each customer requirement. For example a requirement of “easy to attach” can be measured in (1) number of steps in attachment (2) time required to attach (3) number of parts required (4) number of tools required. If you are unable to find an engineering specification for a customer requirement, it is an indication that the customer requirement is not well understood. A possible solution is to break the requirement down into finer parts. Record your engineering specifications.
- 6) The final step here is to define target values for your engineering specifications. These target values will be used to evaluate how well your product meets the customer’s requirements. Really, two steps are involved here, (1) examine the competition for how well they meet the engineering specifications, and (2) establish the value that your product will meet. Performing the first step will require researching the competition well. If you can get to examine physical example, all the better. The best target values are specific values, of less value are ranges of values. Record the target values associated with each engineering specification.

Types of customer requirements:

Functional performance

Flow of energy	(force, motion, hydraulics, electricity, etc.)
Flow of information	(ease of controlling, ability to sense product state)
Flow of materials	(motion of product or items being acted upon)
Operational steps	
Operational Sequence	

Human factor

Appearance	
Force and motion control	
Ease of controlling and sensing state	

Physical Requirements

Available spatial envelope	(size, how fits together, how fits with other system)
Physical properties	(weight, conductivities)

Reliability

Mean time between failures	
Safety (hazard assessment)	(what happens when it does fail?)

Life-cycle concerns (other than use)

Distribution (shipping)	(size, weight, packaging concerns)
Maintainability	
Diagnosability	
Repairability	
Cleanability	
Installability	
Retirement	(design for disassembly)

Resource Concerns

Time	(product development restrictions)
Cost	(capital and production))
Equipment	(available resources)
Standards	(design restrictions)
Environment	("green" concerns)

Manufacturing requirements

- Materials
- Quality
- Company capabilities