

Introduction to Engineering Design with Professional Development I (ENGR 2050)
Classroom Lab Activity

Activity 04-2	Customer Needs vs. Technical Specs
Textbook Reference:	Ulrich & Eppinger, Identifying Customer Needs & Product Specifications
Purpose / Goal:	To understand how customer needs are converted into technical specifications and how to use those to measure project success
Materials / Resources Required:	Laptop, User Needs / Functional Analysis & Customer Needs from previous activities.
Time Allocated:	1 hours

Description

Using the User Needs / Functional Analysis for your mini-project as the context for this activity, you and your partner will seek to convert the important customer needs into measurable technical specifications.

Safety Considerations

Although customers do not often express this, safety requirements are a part of every project. These concerns may range from trivial to substantial but still must be considered. Safety requirements include several sources:

- Governmental Regulations
 - OSHA
 - Food and Drug Administration (FDA)
- Industry Standards
 - National Electric Code
- Common Sense
 - No sharp edges
 - Potential choking hazards
 - No small parts for children's toys
 - Products not used as intended
 - Toasters & bathtubs do not mix!
 - Non-toxic
- Environmental
 - Air / Water Pollution
 - Noise Pollution
 - Impact to wetlands
 - Impact to people or animal traffic
- Organizational
 - School of Engineering Safety requirements

And more! For your mini-project, your table of requirements must include safety related items and how you plan to address them.

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Customers and Stakeholders

We generally recognize customers as “stakeholders” – people with an important “stake” in the success of our projects. It is often helpful, and sometimes required, to consider who the other stakeholders are for a given project.

Examples of additional stakeholders are:

- OSHA
- The FDA
- The Nuclear Regulatory Commission (NRC)
- Other regulatory groups
- Insurance companies
- Patent Holders
- Advertisers

Some of these are safety related and some are groups with financial or legal interests in a project.

Develop a list of the additional stakeholders for your project.

Customer Needs Become Technical Specifications

The textbook, on page 55, clarifies that customer needs are sometimes referred to as “customer requirements” in industrial practice. Customer needs generally are written in the “voice of the customer” while customer requirements have been further interpreted into engineering requirements. For this course, we are attempting to avoid this confusion by using “customer needs” and “requirements” and NOT using “customer requirements”.

As you develop your table of customer needs, be sure to include these other stakeholders and their requirements as well. You may need to create additional tables of Customer Data using the template for these additional “customers”. And based on their wants & needs you will most likely have to update the table of interpreted customer needs as developed in the previous activity.

From the table of customer needs you will now need to convert these to appropriate engineering technical specifications. Start with your prioritized table of customer needs and add three additional columns as shown below in the sample seen in Table 1.

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Table 1 - Customer needs and Technical Specifications

Customer Need	Technical Specification		
	Metric	Target Value / Range of Values	Actual Value / Range of Values
<i>User Comfort</i>	<i>Maximum Noise Level</i>	<i>70db Max</i>	
<i>User Comfort</i>	<i>Maximum Device weight that can be hand carried.</i>	<i>30 lbs Max</i>	
<i>Size – it should fit in my bathroom</i>	<i>Height x width x depth of my bathroom</i>	<i>Up to 10'x12'x10'</i>	
<i>Can be used by a child</i>	<i>Average user's age</i>	<i>3-10 years old</i>	
<i>Can be used by a child</i>	<i>Expected strength capabilities of the average user</i>	<i>5 lbs or less to operate</i>	
<i>Can be used by a child</i>	<i>Average user height</i>	<i>Operating controls no more than 3 feet above ground/floor</i>	
<i>Air dry my winter clothing to be "dry to the touch"</i>	<i>Moisture content at 65 degrees F</i>	<i>2% - 10%</i>	
<i>Support a person</i>	<i>Weight (based on large adult) that can be placed on top of the device</i>	<i>250lbs min</i>	

Table 1 is a sample showing a number of customer needs and how they have been converted to technical specifications. This was accomplished by first reviewing the customer needs data gathered in Activity 02-2. From those tables, the interpreted need becomes the basis for the customer needs and the customer needs drive the technical specifications.

Good specifications are clear and easy to understand. Rather than using a single key word or concept, it is recommended that the specifications contain more details. As in Table 1 - Customer needs and Technical Specifications, rather than use "height" as the specification, the example provided a clearer definition of height as it relates to this project.

Each customer requirement was analyzed to look for a measurement (metric) that could be applied. Examples of possible metrics and their units can be seen in Table 2 - Metrics and Corresponding Units. These would then be applied to each of the customer needs. In the case of the requirement that the item "should fit in my bathroom" the specification should be clear that we are providing the size of my bathroom (other bathrooms may be a different size – but the requirement is to at least fit within MY bathroom). Making clear and accurate specifications is an important part of the engineering design process.

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Table 2 - Metrics and Corresponding Units

Metrics	Units
Volume	Cubic feet
Weight	Lbs.
Launch Speed	Ft/second
Surface Finish	Visual
System complexity	Number of Parts

When converting your table of customer needs to a table of technical requirements as shown in Table 1:

- Create additional rows as needed
- Delete the *italicized example*
- Keep one customer requirement with corresponding technical specification per row
- Create additional rows with the same customer requirement if there are multiple technical specifications
- After each specification is identified, identify the related metrics for it as either a single value (usually an upper or lower limit) or as a range of values.
- Note the last column in the table. Once the project is built you can record your final test result here to help show which requirements you were able to achieve and which ones were not accomplished. A fair, honest and accurate evaluation is critical for good project management!

When you have completed your table of requirements and specifications evaluate them using these questions:

- Are any customer needs missing?
- Are any customer needs redundant? Can any be eliminated?
- Which customer needs require more investigation?
- Do any customer needs prescribe how the concept should be implemented?
- Which customer needs are the most important?
- Which customer needs are the most difficult to implement?

Often you will identify additional requirements as you review your table. Be sure to add these and convert them into the appropriate technical specifications as well.