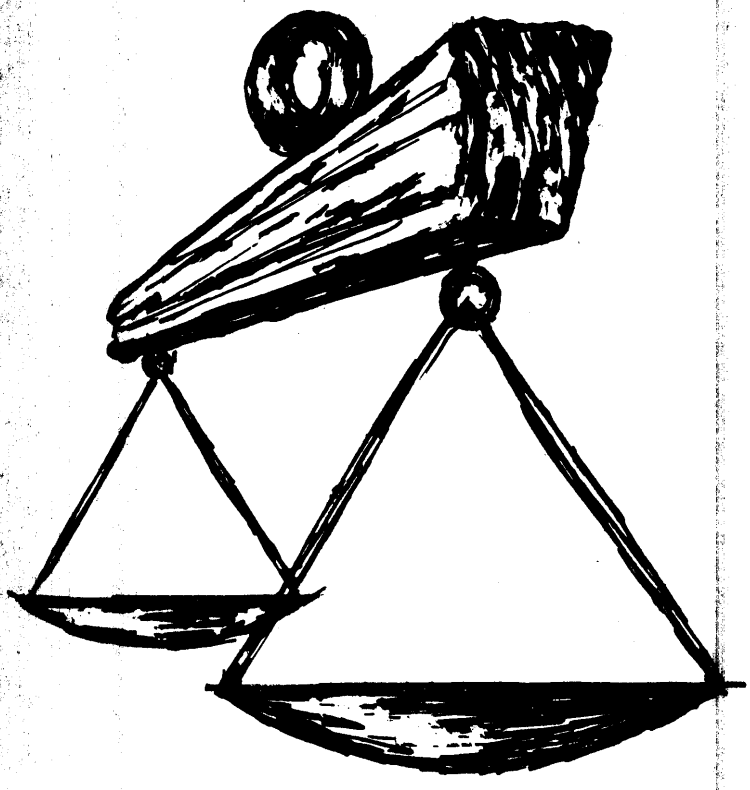


PRODUCT FUNCTION VALUE STANDARD

Transcript of presentation to Television Receiver Department Value Seminar, June 8, 1960 by .....

H. C. Franszen
Value Service
Schenectady, N. Y.

GENERAL ELECTRIC

Throughout this Value Analysis seminar I am sure that you have heard one word repeated over and over again. That word is function. Each of the five suppliers making presentations this morning used this word at least once. I overheard Carl Chase of Gries Reproducer speaking with the group on the television tuner; he was intensively questioning the group as to "What does this part do?" Function is the key to value appraisal and you will hear it over and over again throughout your seminar.

This morning I would like to discuss a tool that is being developed to increase proficiency in the appraisal of value. It is function based. It is called product function value standard.

Now what is a value standard? Suppose we take a very simple illustration. Let's take this piece of chalk, this crayon, my ball point pencil and this pencil that is lying here. What do these have in common? They all make a mark; they have a function in common. What do these various ways of making a mark cost? Well, a pencil costs about two cents, a ball point anywhere from 10¢ up to $10; this crayon - - five cents, this chalk - two cents. This is essentially a value standard. You know from memory what these things cost and what they can do, and with this data you can then appraise their relative value.

Suppose I say I have just spent $5,000 for a 1960 hardtop Chevrolet. Immediately you would be able to develop a judgement as to the value I had received. On the other hand if I said that I paid $1500 for this automobile

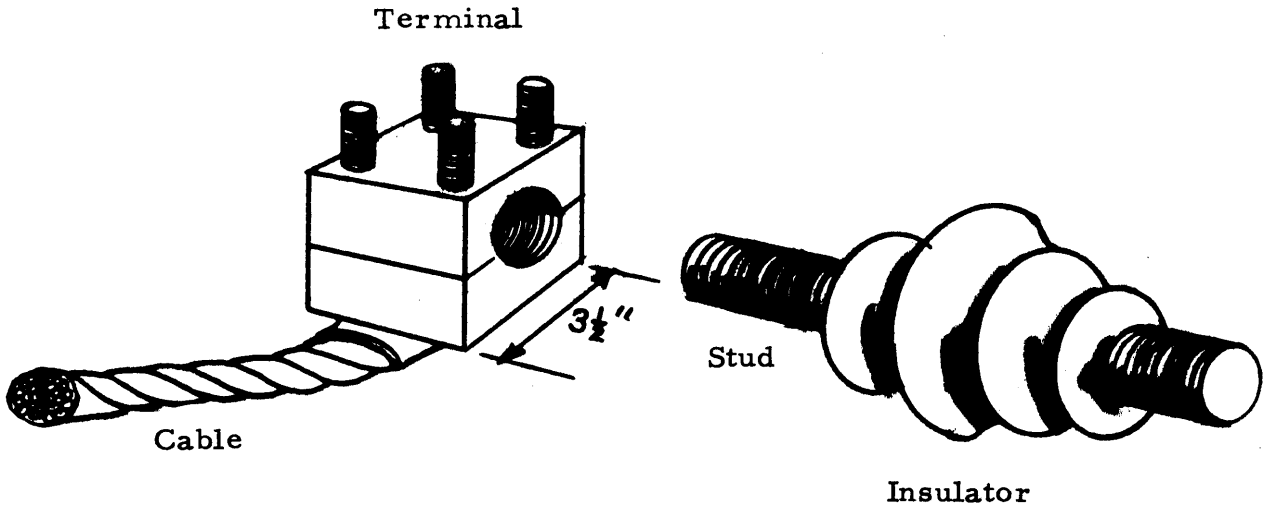
you would be able to quickly determine and appraise the value. However, if I said that a C-band beacon, a black box used in a military equipment, cost $10,000 you would not be able to make a value judgement. If I told you that a power relay cost $52 your value judgement would be somewhat better but probably still not appropriate.

What I have said is something that is fairly obvious, you establish value by comparison, and to do this you need comparison data. The better and more you compare, the better your evaluation data is, the more complete this data is, the better evaluation you will make.

This is what a product function value standard will do. It will provide considerable data to assist in value appraisal of a specified function. These functions will be those found in products used within General Electric designs. It will be in a form that will facilitate comparison. It will allow this to be done before design release in order to give the design engineer a better feel for the value content of his design. It can be used after the design has been released to the factory floor in order to facilitate and identify the removal of unnecessary costs.

An example of the derivation and use of a product function value standard for "terminate conductors" will illustrate its use.

A product department was using three of these terminals in a power transformer. . . .



It is solid copper. The threaded hole fits over a 1-1/2" dia. threaded stud. A cable is brazed to the side of the terminal. The annual usage is 800. Its shop cost $6.03.

Another approach to the appraisal of value is the use of basic function value standards. In a presentation of this concept to a value analysis seminar group it was suggested by one of the seminar participants that the theory and philosophy of this system of measurement should be tried out on one of the seminar projects. One group volunteered their project, which was this terminal. The result was that this terminal was evaluated to be worth about a dollar and a quarter. The speaker then asked whether anyone believed that they could design this terminal so that its cost would be this amount. There was a deathly silence. The speaker then said "You have agreed with the logic of this concept, you have applied this logic to a product with which you are familiar, yet you don't agree with this result." At that point one of the engineers volunteered that this was a design that had been with them for years,

that it had been designed and redesigned to a point where they felt there was little room for improvement. It had been sent to the General Engineering Laboratory who had agreed that this was a sound design. It had been worked on by their engineers prior to the transfer of the product line out of Pittsfield, and that it really would be effort poorly spent to analyze this design any further. Although no one said so, the feeling was that "this design is the ultimate" and, "we defy anyone to do its job for less money." At this point the speaker said he would accept that challenge and see what could be done about it.

A thorough survey was made of a substantial number of terminals and their costs over a wide range of wire sizes and current carrying capacities. An analysis was made of the cost to provide the function of terminate conductor over the complete range available on the market. In the 1200 ampere range, however, there seemed to be nothing available that would cost less than $13. The present cost of $6.03 began to look like a very reasonable price to pay.

A plot was made of the cost versus function data on log-log paper. By establishing a trend line of the lowest cost ways available to accomplish this function it would seem that in the 1200 ampere range a terminal ought to cost $1.50. This was interestingly enough very close to the value calculated by using basic function value standards. (Figure 1)

As more information about terminals rolled in, as the market was more intensively analyzed, several low cost terminals appeared in the 1200 range. One of them was made by a different General Electric department for use by maintenance electricians. It would conduct 1700 amps and cost $2.00.

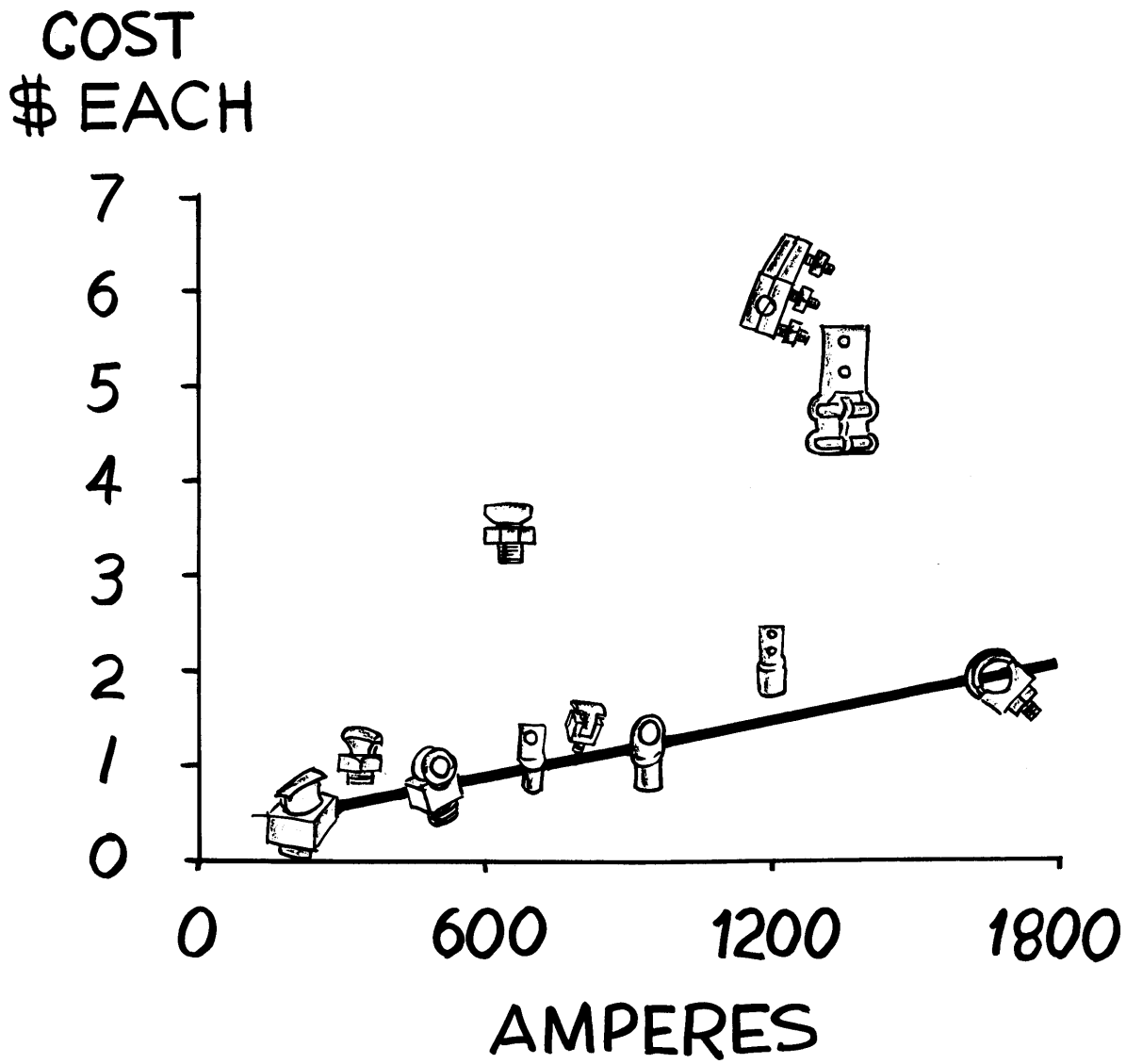
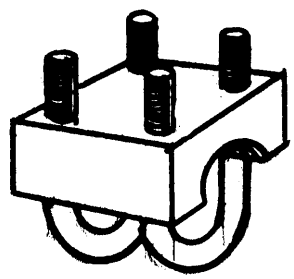


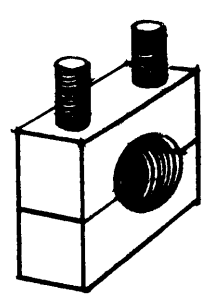
Figure 1

With this information, the value standard and the $2.00 quotation, the engineers showed a renewed interest in redesigning this terminal for a lower cost. A number of ideas were investigated that ranted in cost anywhere from $1.50 to $3.00. One of them was to use two U-bolts instead of 4 straight bolts which would allow the bottom half of the terminal to be eliminated.



When tested it was found that this terminal would accomplish the required function with no heat rise above that of the original terminal. The negative factor was the concern over the U-bolts jimmying the threads on the stud around which the terminal fits. It was agreed however, that this design perform the function and that its cost was less than $3.00. Having overcome the "this design is the ultimate" feeling they once had, they were now able to generate ideas and investigate new courses of action.

The result has been a new design...



A terminal block exactly one-half of the size of the original has been found satisfactory in providing the intended function. Its cost is exactly one-half of the original cost of $6.03.

Now some people may object to the use of the word standards. To them the word standard connotes the highly refined and accurate standards kept in the bureau of standards in Washington, D. C. They think of a one meter rod made from magnesium kept in a temperature controlled vault as being an example of a typical standard. However, there are many kinds of standards, there are standards of performance in your job description. Your boss uses these standards when making performance appraisals. An attempt is made to make these appraisal standards as objective as possible, however, basically they serve more as guides and hand-rails which will help you achieve a common understanding. There are standards of behavior. We each have a general feel for what is commonly accepted, and what is not, in our day-to-day relationships.

Value standards attempt to provide hand-rails that will assist you in making a more informed appraisal of value. Here is a capacitor value standard for tantalum capacitors (Figure 2). We have put cost on a logarithm scale and also the function of capacity on a logarithm scale. We have found that this facilitates comparison which as we mentioned before is basic in any value appraisal. You can see if you follow the vertical dotted line that there is a number of different products available to provide the same function.

PRODUCT FUNCTION VALUE STANDARD

TANTALUM CAPACITORS

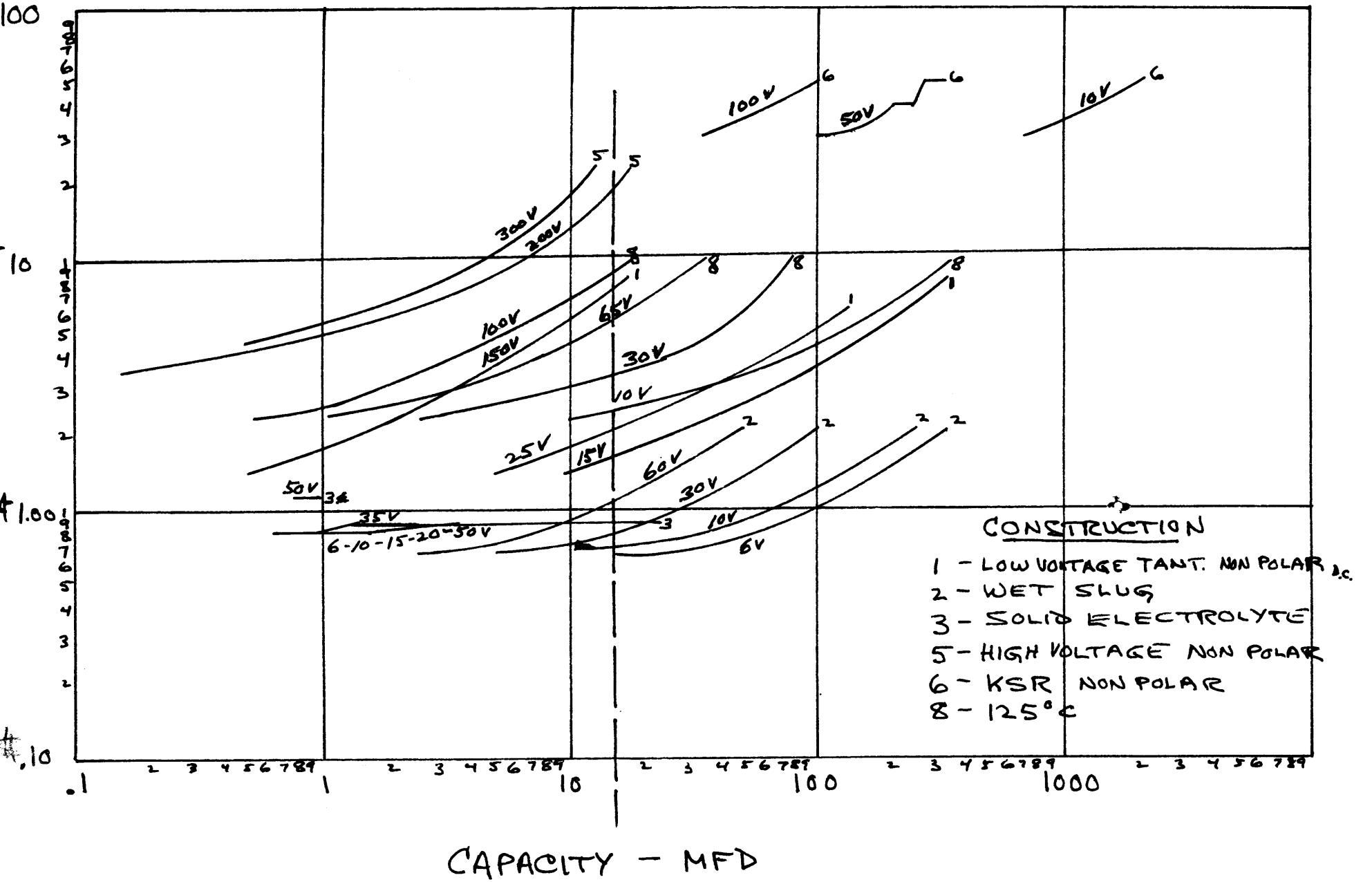


Figure 2

6/3/60

If, for example, you have a need for 15 microfarads of capacity at 10 working volts the value standard shows you that there are at least three different capacitor designs that will satisfy this basic requirement.

TANTALUM CAPACITORS

	15 MFD 10 WORKING VOLTS
SOLID ELECTROLYTE	$ .90 each
LOW VOLTAGE.....	1.40
WET SLUG	.70

You would design for the wet slug capacitor if its properties were sufficient to meet your specifications.

It is interesting to note that these capacitors are similar in many aspects. They are all metal encased, they are plus or minus 10% tolerance, they are all 15 microfarads and can handle the same working voltage, they are all basically the same size, and they all have the advantage of tantalum as an insulator, that is, a lot of electrical capacity per unit volume. They are made by the same manufacturer. Yet their costs are significantly different. I think you can realize the potency of this tool and that you could put it to good use if you had value standards for the many product functions that you design for.

It has been interesting to me to note the different kinds of reactions I get to an explanation of product function value standards and their use. They seem to fall into three classes.

1. "This is blue sky, it's crazy, you can't do it."

2. "We do this all the time, anyone worth his salt does this seven days a week."

3. "When do we get more standards?"

My reaction to (1) is that if I accept that I can't do it I won't try and naturally, in such a case, I can't do it. I think what we really mean is that we don't know how to do it. Obviously if we are going to progress we are going to have to try many things to see what their strengths are and then regroup and redirect our efforts. To the comment that "we are already doing it," I wonder if we really are. I suspect the problem might be that people often confuse fact and logic. We often run into this in Value Analysis. I would like to point out what I mean by the confusion of fact and logic by reading this. It states the point very well.

> "Logically, it seems that Value Analysis duplicates existing functions since Value Analysis specialists work within the Engineering, Planning and Methods, and Purchasing areas. It also seems reasonable to assume, on the basis of logic, that value analysis could not be productive because the buyers are getting the best sources, the engineers the best designs and the manufacturing people are using the best methods. Also it might seem that in the high volume lines specialists have combed every area and in the low volume lines the job-shop nature of this business, the non-recurring items, small quantities and requirements for interchangeability would make further work unprofitable. Hence on the basis of logic there would be no need for value analysis."
>
> "On the basis of fact, however, qualified, well-trained value analysis specialists, properly understood and supported, can go into each of these areas and bring out ten to hundreds of thousands of dollars in unnecessary costs."

Logically it would seem that "we do this all the time." In fact, I question it.

I recently heard another reaction; given by Dr. Hartman, Professor of Philosophy in the University of Mexico. This one was that we have a "bull by the tail, except we don't know it yet."

So far we have discussed what a value standard is, how it is used, and how it is derived. Next I would like to discuss what product function, product function value standards should be derived for and also go into more detail as to what function is; what we mean when we say the word function.

Value Analysis teaches that a function is anything that makes a product work better or sell better. Suppose we go into this in a little more detail.

Let's take a hypothetical situation, one that is very simple yet serves to illustrate the concept. Suppose you are out hunting by yourself in the woods and you step into a pot hole and injure your leg. You can't rest your weight on your left leg, you are alone, and there is no one within shouting distance. You now have a need, you have to get out of the forest to get first-aid. What should you do? Well, the usual solution for something like this is to use a crutch. You could use your gun as a crutch but this has certain disadvantages. Finally your eyes come to rest on a stick that to you has the properties of a crutch, specifically these:

It is four feet long.

It will support 180 pounds in compression.

One end of the stick has the shape of a hook which will rest under your arm.

It weighs four and one-half pounds.

It has a number of other properties but these are the properties that you abstract for your particular needs. If, for example, you were interested in using this stick as a cudgel you would become interested in its property of bending strength. Or, if you wished to start a fire with it, its ability to support combustion becomes important. But the point here is that it does have a number of inherent properties, available for you to use, the limitation being your ability to create a use for these properties.

In summary then, the things that are found in nature and the products that are manufactured by man:

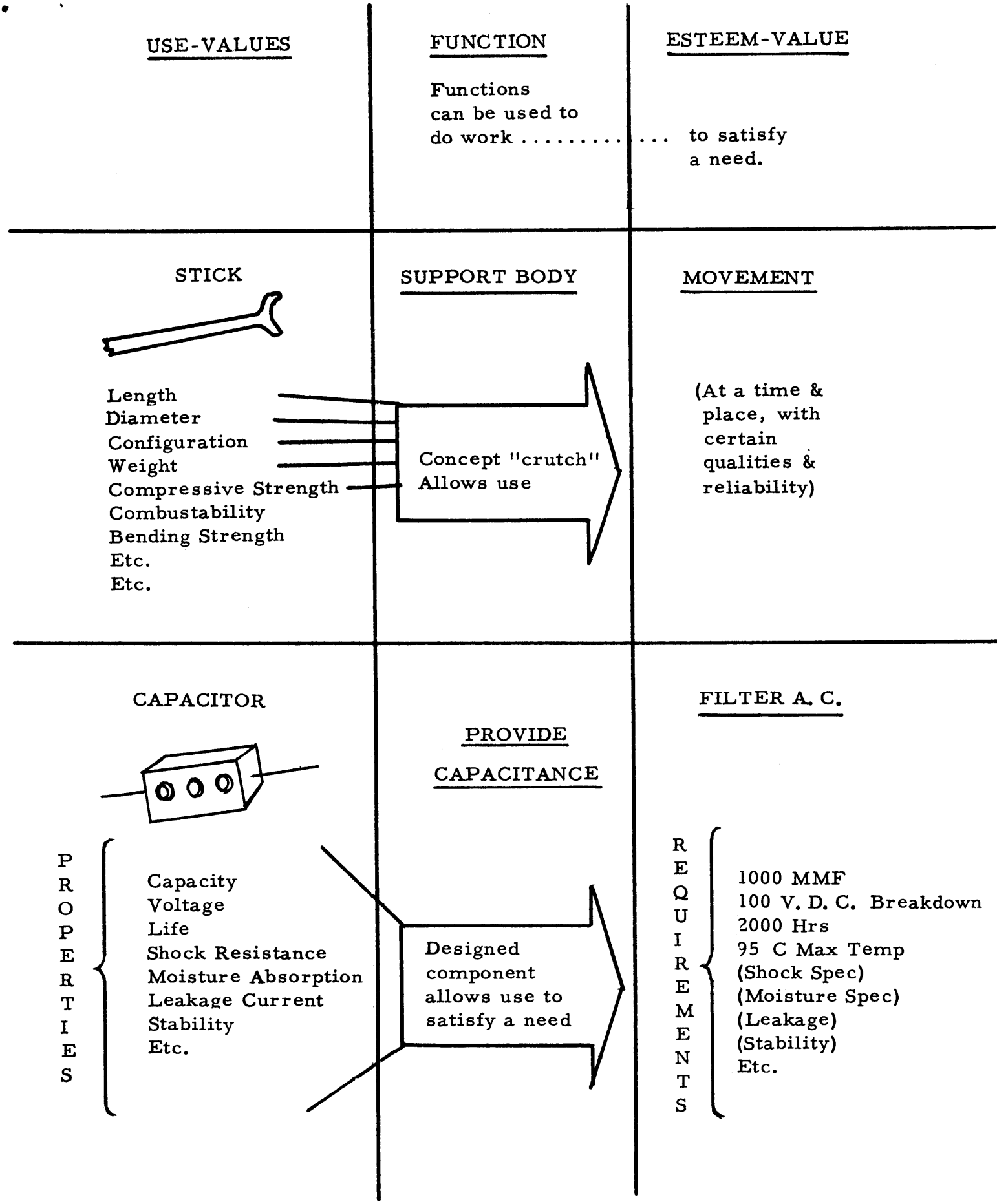
1. Have properties
2. These properties are called use-values. These use-values are objective, that is they are in the thing and have nothing to do with the person using the thing.
3. When you are in a situation where you need these properties they suddenly attain an esteem-value. This is very much subjective and depends on your needs for the properties of the device, your knowledge, and your creative ability.

STICK BEFORE LEG INJURY - LITTLE OR NO ESTEEM VALUE

AFTER INJURY ---------- CONSIDERABLE ESTEEM VALUE

SAME USE-VALUES BEFORE AND AFTER INJURY

Function is the planned action with which properties can be used in order to satisfy a need. It is the bridge between use-value and esteem-value. A function is the utilizing of the properties of a device or use-values in order to satisfy a need or esteem-value (Figure 3).


USE-VALUES
FUNCTION
ESTEEM-VALUE
Functions can be used to do work . . . . . to satisfy a need.
STICK
SUPPORT BODY
MOVEMENT
Length
Diameter
Configuration
Weight
Compressive Strength
Combustability
Bending Strength
Etc.
Etc.
Concept "crutch" Allows use
(At a time & place, with certain qualities & reliability)
CAPACITOR
PROVIDE CAPACITANCE
FILTER A. C.
PROPERTIES
Capacity
Voltage
Life
Shock Resistance
Moisture Absorption
Leakage Current
Stability
Etc.
Designed component allows use to satisfy a need
REQUIREMENTS
1000 MMF
100 V. D. C. Breakdown
2000 Hrs
95 C Max Temp
(Shock Spec)
(Moisture Spec)
(Leakage)
(Stability)
Etc.

(Figure 3)

According to this definition there are relatively few functions, perhaps 100 to 150. This does not include such factors as time, place, quality or reliability. These are specifications as to how well the function is to be performed. It is related to need, to esteem-value. In the crutch example, the stick had a function of support body. Your need was to allow you to move to a place where you could get first-aid. You needed it right now (time), within a reasonable reach (place), with the properties such as rigidity, shape, weight, length (qualities), and with sufficient reliability to supply these qualities for the length of time you anticipate you will need the crutch.

Now, for what kinds of products should we investigate function and develop product function value standards. What are our limits as to the scope of this job.

1. We should limit ourselves to products that are of interest to General Electric product designers for use in their designs. There are innumerable products on the market but we must exclude such things, obviously, as golf clubs and cue sticks and instead look into products such as, relays, capacitors, fasteners, etc.
2. We will not look into products which are essentially equipment or tooling. Our focus is the building blocks used in design engineering rather than manufacturing engineering.
3. We will look at component products only. This will exclude, by definition, materials and processes.

I made an initial survey to determine the variety of product functions that are available within these specifications. To do this I took copies of five trade magazines and analyzed the functions of the products that were advertised in them. These magazines included:

Electrical Design News

Design News

Machine Design

Electrical Manufacturing

Production

This resulted in about 100 different product classes and I would estimate that there will be anywhere from 100 to 150 value standards.

When listing these product functions it is interesting to note that they fall into a definite pattern. The output of the great majority of these components is either a mechanical force, a fluid or pneumatic force, it deals with electrical or magnetic energy, or thermal energy. Each one of these outputs in turn, are affected in various ways. They are either supplied, restricted, controlled, shut on or off, are transmitted or are measured. If you will refer to the matrix (Figure 4) you will see these various outputs listed in the headings across the top with the various ways that they are affected listed across the side. This becomes a terrific creative tool. The first step in creating a design is the awareness and specification of a need. We must for example supply a mechanical force or restrict a fluid source and by referring to these in the matrix we see a number of products listed that provide this basic function. For each of these product classes a product function value standard will be derived and in addition

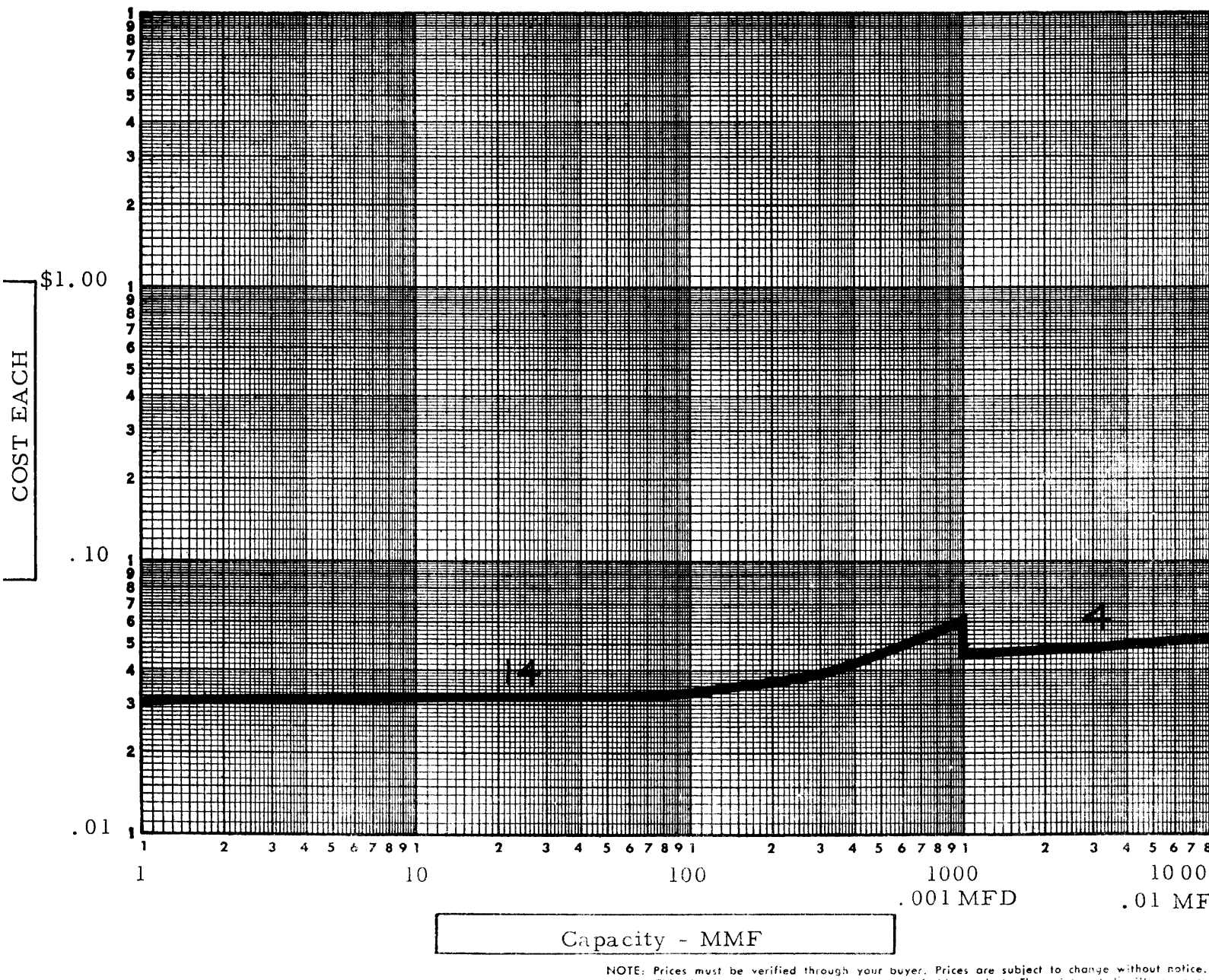
		Mechanical Force	Fluid/Pneumatic Force	Electrical/Magnetic Energy	Thermal Energy	Other
A C T I O N S	Provide Store Supply	Meters, elec, spring, air Servos Transducers Springs Engines Air Cylinders Torque Actuators Bellows	Blowers Fans Pumps	Power supplies Capacitors Servos Batteries Thermocouples Transformers Transducers Generators	Heating element Lamps	
	Prevent Restrict	Sleeving Terminal blocks Bearing, sleeve/ball Tapes Spacers Fasteners Hinges Covers, protectors Containers Strain Reliefs Springs Collars Vibration isolators	Seals Filters	Rectifiers Resistors Capacitors Chokes Sleeving Shielding		
	Control Regulate	Clutches Transmissions	Pressure regulators Valves	Transistors Tubes Thyristors		
	ON - OFF	Brakes	Valves	Switches Plugs Thermostats Receptacles Fuses Cir.breakers Terminals		
	Conduct Transmit	Handles Couplings Knobs Gear Trains Fasteners Differentials Belt, chain drives Pulley, sprockets Push pull controls Universal joints Transmissions	Hose/pipe Pipe/hose connections	Contacts Magnetic pick-ups Wire/cable Terminals Plugs Receptacles Printed circuit	Heat sinks Heat exchangers	
	Measure Indicate	Timer, mech. Hardness gages Tachometers Counters Accelerometers Vibration meters	Barometers Gages, pressure Gages, vacuum Liquid level gages Timers	Horns, bells, buzzers, sirens Lamps Timer switches Gauss-meters Wattmeters Ammeters Voltmeters	Thermometers	Nameplates

Figure 4

PRODUCT FUNCTION
VALUE STANDARD

CAPACITANCE

FOR USE OF GE[illegible] ELECTRIC EMPLOYEES ONLY

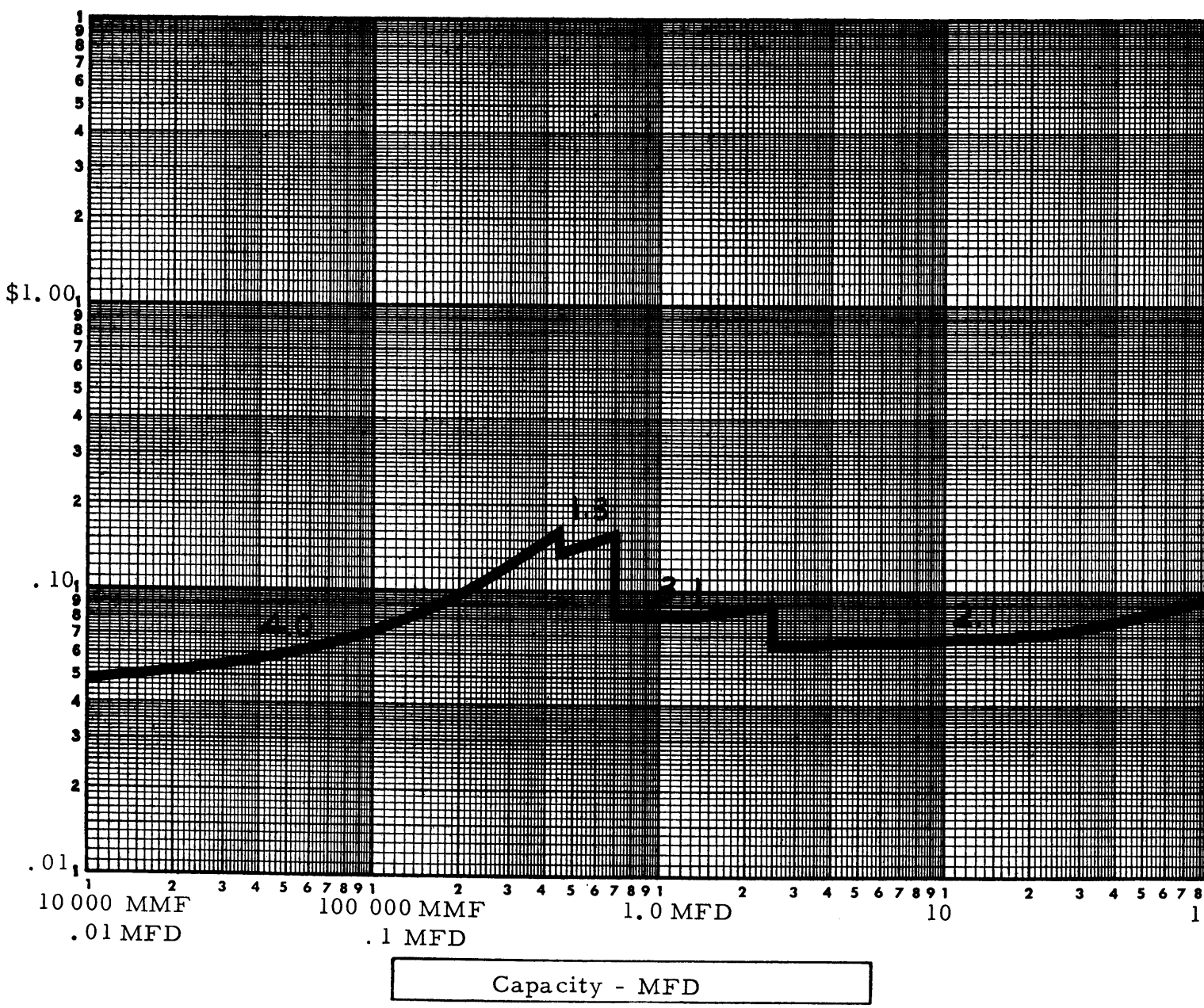


NOTE: Prices must be verified through your buyer. Prices are subject to change without notice. This does not represent an endorsement of this product. Those interested will communicate directly with the manufacturer for additional evaluation data.

PRODUCT FUNCTION VALUE STANDARDS

CAPACITANCE

FOR USE OF GENERAL ELECTRIC EMPLOYEES ONLY

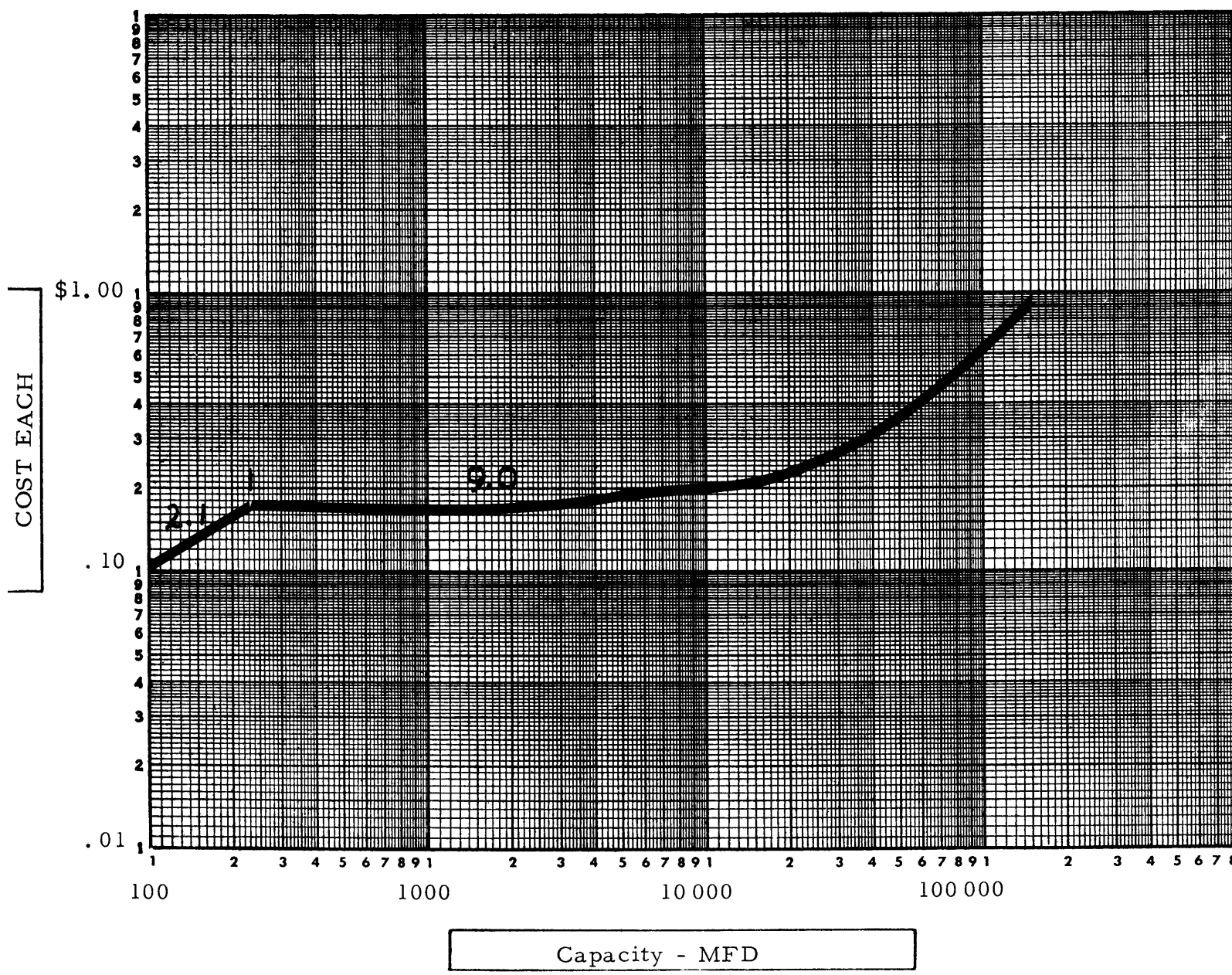


NOTE: Prices must be verified through your buyer. Prices are subject to change without notice. This does not represent an endorsement of this product. Those interested will communicate directly with the manufacturer for additional evaluation data.

PRODUCT FUNCTION VALUE STANDARD

CAPACITANCE

FOR USE OF GENERAL ELECTRIC EMPLOYEES ONLY



NOTE: Prices must be verified through your buyer. Prices are subject to change without notice. This does not represent an endorsement of this product. Those interested will communicate directly with the manufacturer for additional evaluation data.

REF. 4

5/16/60

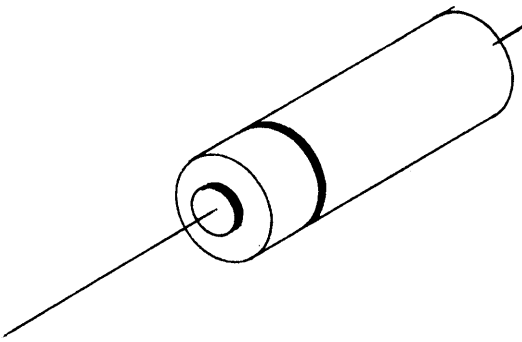
PRODUCT FUNCTION VALUE STANDARD

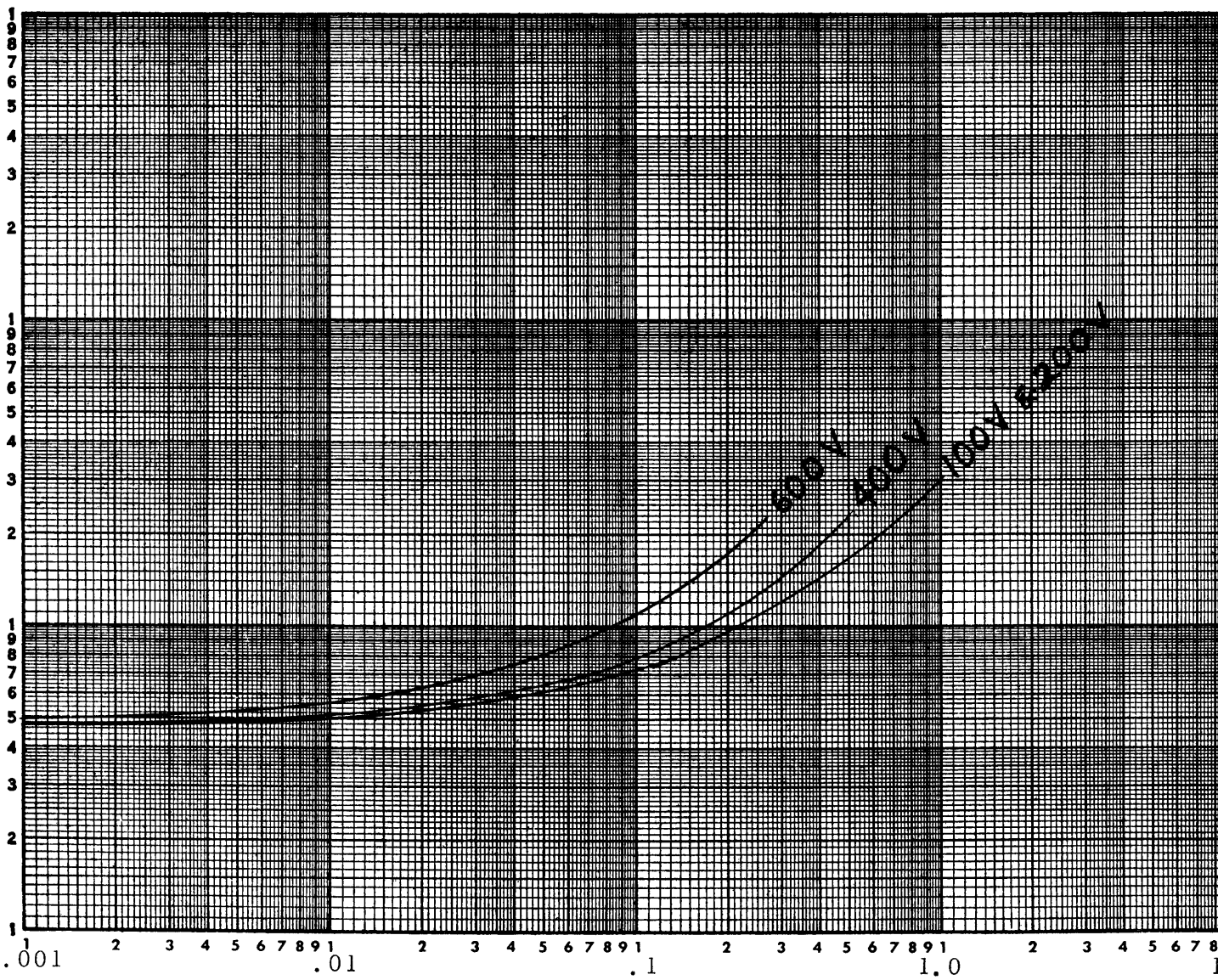
FOR USE OF GENERAL ELECTRIC EMPLOYEES ONLY

CAPACITY

MOLDED MYLAR

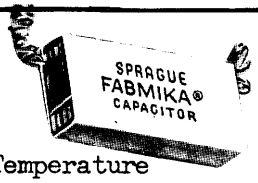
± 10% TOL.





NOTE: Prices must be verified through your buyer. Prices are subject to change without notice. This does not represent an endorsement of this product. Those interested will communicate directly with the manufacturer for additional evaluation data.

FOR USE OF GENERAL ELECTRIC EMPLOYEES ONLY

	PRODUCT	PROPERTIES	COST
22	 High-Temperature Stacked-Foil Fabmika Sprague Elec. Co. No. Adams Mass.	High temperature operation to 260°C and 310°C Radiation resistance Low dissipation factor results in small capacitors with minimum rise in temperature.	Type 200M, ± 10% .01MFD 300 V CAT $2.10 1.0MFD 300 V CAT $2.95 .01MFD 6000 V CAT $3.60 1.0MFD 6000 V CAT $3.92
23	 Vehicular Bypass Sprague No. Adams Mass.	High vibration and shock resistance Hermetically sealed	Type 131 J .01MFD 100 V CAT CA-430 $ .21 .5MFD 100 V CAT CA-460 $ .39
24	 Cardboard-case Paper tubulars Sprague No. Adams Mass.	Heavy dip of protective wax. Temp - 30°C to +85°C	Type 133 P Style AG ± 10% .001MFD 200 V CAT 132P10292 $ .10 1.0MFD 200 V CAT 132P10592 $ .12 .001MFD 1600 V CAT 133P102916 $ .28 .047MFD 1600 V CAT 133P473916 $ .34
25	 125 C Prokar Molded tubulars Sprague No. Adams Mass.	Small size 125°C Solid dielectric	Type 65P, ± 10% .012MFD 100 V CAT 65P12391 $ .11 .15MFD 100 V CAT 65P15491 $ .18 .00082MFD 400 V 65P82194 $ .23 .022MFD 400 V 65P22394 $ .31

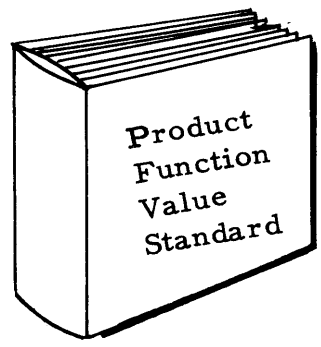
Prices must be verified through your buyer. Prices are subject to change without notice. This does not represent an endorsement of this product. Those interested will commun-

to the cost versus product function relationships, such as we have talked about for the terminals and for the capacity, there will be back-up sheets (Figure 5) showing the specifications of the products that went to make up the value standard.

To summarize: product function value standards present the relationship between the cost of the function provided by a product and the products cost. It is presented in such a way as to facilitate comparison. It is backed up with information which explains in more detail the specifications of the products that went to make up the standard. We estimate there will eventually be about 100 to 150 such standards. These standards will provide a readily used and understood tool for the appraisal of value during and after design release.

The next question is when do we get them? Here is the schedule we have established.

MAR	DETAILED CONCEPT & COMMUNICATION FORMAT	
APR		
MAY	Capacitors	
JUNE	Terminals	
JULY	Terminal Boards	Bearings
AUG	Relays	Handles/Knobs
SEPT	Resistors	Fasteners
OCT	Batteries	Valves
NOV	Switches	Springs
DEC	Motors	Containers



We have a target of 15 standards by the end of this year. We are scheduling program completion by the end of 1962.

General Electric has been the originator of the value concept and techniques, and has supplied the leadership in the field of Value Analysis over the past 12 years. Many of our competitors are seriously challenging this leadership. With the potency to strike at the heart of a business, the competitiveness of its products, Value Analysis is a field where we must maintain our lead.

We in the Value Research group of Value Service are striving to think through and develop new concepts that will continue G. E. 's status as a value winner. Product Function Value Standards is one of the tools with which we must sustain our lead.