

Proprietary Information

61

AN "X-RAY" OF THE ANATOMY OF UNNECESSARY COSTS

in

General Electric Products

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INTRODUCTION

It is the purpose of this report to inform General Electric management in depth...

- ...what types of actions must and can be taken
- ...who must take the actions
- ...the types of changes which must be produced

...in order to manufacture high grade products at very much lower cost levels, and to establish General Electric earnings at a proper level.

SPECIAL NOTE

Results herein discussed were produced through the means of a special Value approach--a Value Task Force; however, it is not the intent of this report to promote after-the-fact task forces. It will continue for a time to be appropriate to occasionally run Value Task Forces for quick earnings. However, their need is minimized by the Value Control System which is now available to the departments.

The depth knowledge included will assist managers in evaluating for their own businesses the benefits to be obtained by using the General Electric Value Control System to assure appropriate product costs.

Value Service
L. D. Miles, Manager

LDM:AEM

9/61

THE VALUE PROBLEM--UNDER X-RAY

1. The products were the ML32 Single Phase Voltage Regulators.
2. They represent approximately \$6,000,000 of sales in 1961.
3. It is a basic General Electric product. We have been securing 40% of the market and earning well above the company average. It has been cost reduced an average of 4% to 5% of applied material and labor per year during the past several years.
4. Selling prices fell as low as 40% from published prices, which reduced our earnings position.
5. In January of 1961, section general manager Butler took action which would reverse the unfavorable earnings trend.
6. The changes required to restore profitability at the lower market levels are here reported for the guidance of other General Electric managers.
7. They are scheduled to be in the production line by the last quarter of 1961.
8. How he accomplished the changes is shown at the end of the report.

RESULTS --

WORK AREAS IN WHICH CHANGES WERE MADE TO SECURE
THE \$1,160,000 OF LOWER COSTS

		<u>\$ in M</u>
13 items	Change vendor	47
4 items	Make to buy	17
1 item	Change ordering procedure	7
27 items	Change design	136
21 items	Change design and vendor	410
1 item	Change design and material	3
2 items	Change material size	13
10 items	Change material specification	128
14 items	Change design concept	104
3 items	Change assembly	5
3 items	Change vendor and method	5
1 item	Change vendor and process	2
5 items	Change shop procedures	58
2 items	Change design and methods	68
3 items	Change design and processes	32
1 item	Change design and assembly	4
3 items	Change material	8
5 items	Change material and methods	31
6 items	Change material and process	42
1 item	Change design, vendor, and process	40
<hr/>		<hr/>
20 types of changes		1,160
126 items		

RESULTS---

CLASSIFICATION OF CHANGES--I & II--REQUIRED
TO REMOVE COSTS OF \$1,160,000/YEAR

I No Manufacturing Methods Change Required	\$414,000
A. No Engineering or Drafting Change	\$ 71,000
B. Minor Engineering or Drafting Change	277,000
C. Major Engineering or Drafting Change	66,000
II Manufacturing Methods Change Required	\$746,000
A. No Engineering or Drafting Change	\$ 73,000
B. Minor Engineering or Drafting Change	633,000
C. Major Engineering or Drafting Change	40,000
	<hr/>
	\$1,160,000

SUMMARY

UNNECESSARY COST BEING ELIMINATED

To Distribution Transformer Department	\$471,860
To other Power Transformer Department Sections	111,878
To own manufacturing area	37,057
To outside vendors	222,676
For non-functional items eliminated (either money was spent for something which contributed no function or modifications in other reported items now also accomplish this entire function)	97,445
For various changes not included in the above but each item involving various extra costs so that none fits exclusively into any one of the above five classes.	<u>178,781</u>
	\$1,119,700

MATERIAL AND LABOR REDUCTIONS BEING PUT INTO EFFECT BY THE LAST QUARTER 1961 AS PROPOSED At Annual Rate

	Material <u>In</u> <u>\$</u>	Labor <u>In</u> <u>\$</u>
Distribution Transformer	\$507,795	\$ -0-
Outside Vendor	81,596	-0-
Regulator	18,233	68,248
Tank Shop	32,333	42,928
Internal Comp.	64,626	8,586
Tube Rolling	2,633	776
Asm. & Test	483	805
Screw Machine	3,360	-0-
Various	<u>24,579</u>	<u>6,280</u>
	\$735,638	\$127,623

SUMMARY OF CHANGES BY CLASSIFICATIONS I & II

I - No Manufacturing Methods Change Required

		<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
A. No Engineering or Drafting Change					
Change Vendor	- 13 items	\$108,016	\$ 61,255	\$ 46,761	43%
Make to Buy	- 4 items	37,741	19,998	17,743	47
Change Ordering Procedure In Shop	- 1 item	6,674	-0-	6,674	100
				<hr/>	
SUB-TOTAL				\$ 71,178	
 B. Minor Engineering or Drafting Change					
Change Design	- 17 items	\$105,915	\$ 42,719	\$ 63,196	60%
Change Design & Vendor	- 14 items	55,851	21,075	34,776	62
Change Design & Material	- 1 item	3,150	352	2,798	88
Change Mat'l Size	- 2 items	39,202	26,419	12,783	33
Change Mat'l Specification	- 10 items	353,172	224,800	128,372	36
Eliminate	- 14 items	38,352	2,962	35,390	92
				<hr/>	
SUB-TOTAL				\$277,315	
 C. Major Engineering or Drafting Change					
Change Design	- 7 items	\$226,555	\$160,168	\$ 66,387	29%

II - Manufacturing Methods Change Required

	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
A. No Engineering or Drafting Change				
Change Assembly - 3 items	\$ 19,530	\$ 14,700	\$ 4,830	24%
Change Vendor - 2 items	6,828	4,578	2,250	33
Change Vendor & Method - 3 items	6,722	1,549	5,173	77
Change Vendor & Process - 1 item	1,716	118	1,598	93
Change Shop Procedure - 5 items	211,010	153,030	57,980	27
Eliminate Lettering - 1 item	1,175	-0-	1,175	100
SUB-TOTAL			\$ 73,006	
B. Minor Engineering or Drafting Change				
Change Design - 3 items	\$ 15,124	\$ 8,607	\$ 6,517	43%
Change Design & Vendor - 7 items	671,571	296,658	374,913	56
Change Design & Methods - 2 items	85,274	17,684	67,590	79
Change Design & Process - 3 items	53,412	21,711	31,701	59
Change Design & Assembly - 1 item	4,722	866	3,856	82
Change Material - 3 items	19,785	11,414	8,371	42
Change Material & Method - 5 items	50,520	19,325	31,195	61
Change Material & Process - 6 items	62,102	20,413	41,689	67

II - Manufacturing Methods Change Required (Cont.)

		<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
B. Minor Engineering or Drafting Change (Cont.)					
Eliminate	- 3 items	84,356	16,803	67,553	80
				<hr/>	
SUB-TOTAL				\$633,385	
C. Major Engineering or Drafting Change					
Change Design, Process & Vendor					
	- 1 item	\$ 56,800	\$ 15,980	\$ 40,820	72%
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TOTAL				\$1,160,000	

ANALYSIS OF CHANGES BY CLASSIFICATIONS I & II

I - No Manufacturing Methods Change Required

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
A. No Engineering or Drafting Change					
<u>Change Vendor</u>					
Control Panel	1-409	\$24,041	\$10,881	\$13,160	55%
Weld Nuts	1-404	1,737	165	1,572	90
Weld Nuts	1-410	3,760	729	3,031	81
Plate	1-408	3,618	729	2,889	80
Collar	1-004	1,293	400	893	69
Bracket	1-101A	494	176	318	64
Core	1-204	9,400	3,995	5,405	58
Bolt	3-003	846	47	799	94
Connector	2-204A	1,870	428	1,442	77
Connector	2-206	13,372	8,249	5,123	38
Spacers	3-014	17,891	9,605	8,286	46
Duct	3-025	413	307	106	25
Motor	2-004	29,281	25,544	3,737	13
				<u>\$46,761</u>	
<u>Make to Buy</u>					
Coil	1-209	7,050	2,256	4,794	68
Coil	1-210	4,677	2,162	2,515	54
Timer Motor					
Pinion	1-004	5,264	235	5,029	95
Coil	1-108	20,750	15,345	(5,405)	25
				<u>\$17,743</u>	
<u>Change Ordering Procedure In Shop</u>					
Set Up Charges	1-900	6,674	-0-	<u>\$ 6,674</u>	100
SUB-TOTAL				\$71,178	

B. Minor Engineering or Drafting Change

Change Design

Rheostats	1-406	8,460	6,251	2,209	26%
Circuit Brkr	1-303	3,455	2,726	729	20
Resistor	1-006	2,632	423	2,209	84

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
Capacitor	1-103	\$ 6,439	\$ 4,371	\$ 2,068	32%
Bushing	1-206	2,773	682	2,091	75
Gear	1-008	6,369	1,340	5,029	79
Capacitor	1-003	5,217	1,692	3,525	68
Rheostat	1-306	16,662	8,037	8,625	52
Base	2-003	752	94	658	88
Indicator Drive	2-006	10,763	7,214	3,549	32
Indicator Switch	2-009	10,763	2,063	8,700	82
Clamp	2-202	5,456	1,706	3,750	69
Clamp	2-208	8,026	2,568	5,458	68
Lead	4-002	6,946	966	5,980	86
Buckeye Flg	4-003	4,670	1,130	3,540	76
Ind. Dial	4-002	5,475	1,292	4,183	76
Ground Strap	3-002	1,057	164	893	85
				<u>\$63,196</u>	

Change Design and Vendor

Bracket	1-401	4,348	1,110	3,238	75
Tube & Nut	1-402	2,115	423	1,692	80
Panel Knobs (2)	1-403	2,209	235	1,974	89
Brackets	1-701	1,786	611	1,175	66
Brackets	1-702	3,055	611	2,444	80
Terminal Bd	1-400	2,120	846	1,274	60
Transformer	1-001	8,061	3,713	4,348	54
Panel	1-102	5,335	1,410	3,925	73
Support	1-205	2,186	494	1,692	80
Transformer	1-001A	3,713	3,055	658	18
Tube Cap Screws	2-002	1,704	1,069	635	39
Bracket	2-014	7,050	2,350	4,700	67
Connectors	2-015	3,888	1,763	2,125	55
Connectors	2-016	8,281	3,385	4,896	60
				<u>\$34,776</u>	

Change Design and Material

Tapstrap	2-203	3,150	352	\$ 2,798	88
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Change Material Size

Paper	3-011	3,040	1,040	2,000	66
Strap	3-022	36,162	25,379	10,783	30
				<u>\$12,783</u>	

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
<u>Change Material Specification</u>					
Reactor Core					
Steel	1-600	\$29,769	\$17,506	\$12,263	41%
Pot. Transf.					
Core Steel	1-700	8,361	5,968	2,393	28
Current Transf.	1-800	1,102	796	306	28
Plate	2-005A	24,229	7,544	16,685	69
Bracket	2-017	776	47	729	94
Couple Plate	2-019	4,371	2,515	1,856	42
Insulation	3-009	2,115	634	1,481	70
Capacitor	2-001	5,382	1,880	3,502	65
Case	1-208	17,067	6,110	10,957	65
Core Steel	3-004	260,000	181,800	78,200	30
				<u>\$128,372</u>	

Eliminate

Name Plate	1-301	47	-0-	47	100
Name Plate	1-200	282	-0-	282	100
Name Plate	1-200A	2,820	-0-	2,820	100
Test	1-601	8,366	-0-	8,366	100
Rheostat Panel	1-307	1,504	-0-	1,504	100
Insulation	2-201	2,350	352	1,998	85
Brace	2-010	1,105	-0-	1,105	100
Connection	2-209	371	-0-	371	100
Connection	2-209	1,573	-0-	1,573	100
Clamps	3-007	1,504	-0-	1,504	100
Tap Pads	3-026	495	-0-	495	100
Braces	4-004	7,052	-0-	7,052	100
Decal	1-405	2,233	71	2,162	97
Fluidizing	4-006	8,650	2,539	6,111	70
				<u>\$35,390</u>	

SUB-TOTAL \$277,315

C. Major Engineering or Drafting Change

Change Design

Pot. Trans.	2-007	116,559	85,681	30,878	26
Shelves	2-012	32,759	23,500	9,259	28

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
Sw. Brkt	2-018	\$14,852	\$10,810	\$ 4,042	27%
Arching Edge	2-022	38,203	35,976	2,227	6
Arching Edge	2-023	3,681	2,366	1,315	36
Arching Edge	2-026	2,805	1,835	970	35
Base (Elim.)	2-008	17,696	-0-	17,696	100
				<u>\$66,387</u>	

II - Manufacturing Methods Change Required

A. No Engineering or Drafting Change

Change Assembly

Bracket	1-101A	\$ 494	\$ 176	\$ 318	64%
Bracket	1-100	2,256	494	1,762	78
Beam	2-207	16,780	14,030	2,750	16
				<u>\$ 2,830</u>	

Change Vendor

Valve	4-012	3,838	2,888	950	25
Name Plate	4-019	2,990	1,690	1,300	44
				<u>\$ 2,250</u>	

Change Vendor and Method

Locking Knobs	1-407	2,209	-0-	2,209	100
Test Rheostat	1-308	3,502	1,105	2,397	68
Adapter	2-011	1,011	444	567	56
				<u>\$ 5,173</u>	

Change Vendor and Process

Tube & Collar	1-402A	1,716	118	\$ 1,598	93
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Change Shop Procedure

Re-Study Mch. Shop					
	2-301-a	2,840	2,000	840	30
Time Study Crnk Assy					
	2-301-b	2,780	1,850	930	33
Omit Punch Tap Lds					
	2-301-c	31,300	21,800	9,500	30
Study of Labor	2-302	5,090	2,380	2,710	53
Study of Labor	2-301-d	169,000	125,000	44,000	26
				<u>\$57,980</u>	

Eliminate Lettering

Cover Decals	4-013	1,175	-0-	<u>\$ 1,175</u>	100
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SUB-TOTAL \$73,006

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
B. Minor Engineering or Drafting Change					
<u>Change Design</u>					
Screw	1-201	\$ 3,126	\$ 188	\$ 2,938	94
Counter Assy	1-305	10,458	7,579	2,879	28
Ground Term.	4-007	1,540	840	700	45
				<u>\$ 6,517</u>	
<u>Change Design and Vendor</u>					
Sockets & Plugs	1-304	5,711	1,481	4,230	74
Tank	4-016	121,655	49,125	72,530	60
Tank	4-016	103,091	49,940	53,151	52
Tank	4-016	102,474	43,569	58,905	57
Tank	4-016	284,765	119,601	165,164	58
Tank	4-020	49,125	32,153	16,972	35
Ground Term.	4-018	4,750	789	3,961	84
				<u>\$374,913</u>	
<u>Change Design and Methods</u>					
Clamp & Uprights					
	3-015	78,742	15,848	62,894	80
#1 Lead	3-008	6,532	1,836	4,696	72
				<u>\$67,590</u>	
<u>Change Design and Process</u>					
Tap Strap & PP Tube					
	4-015	12,250	5,757	6,493	53
Inserted Base	4-001	30,573	11,637	18,936	62
Inserted Base	4-011	10,589	4,317	6,272	59
				<u>\$31,701</u>	
<u>Change Design and Assembly</u>					
Tap Strap & PP Tube					
	4-008	4,722	866	\$ 3,856	82
<u>Change Material</u>					
Corner Spacer	3-017	1,253	280	973	78
Tank Cover Bands	4-009	6,030	2,520	3,510	58
Bushing Term.	4-017	12,502	8,614	3,888	31
				<u>\$ 8,371</u>	
<u>Change Material and Method</u>					
Insulator	3-013	32,430	16,520	15,910	49
Taps	3-016	1,316	451	865	66
Insulators	3-029	512	192	320	62

<u>Name of Part</u>	<u>Change #</u>	<u>Cost</u>	<u>Changed Cost</u>	<u>Savings</u>	<u>% Decrease</u>
Banding Iron	3-006	\$ 8,836	\$ 987	\$ 7,849	11%
Clamps	3-010	7,426	1,175	6,251	84
				<u>\$31,195</u>	

Change Material and Process

Gear	1-008	6,369	1,340	5,029	79
Collector	2-013	3,948	987	2,961	75
Gears	2-020	21,400	11,941	9,459	44
Gear	2-020-437	16,215	1,786	14,429	89
Gear	2-020-438	10,105	3,525	6,580	65
Gear	2-020-971	4,065	834	3,231	79
				<u>\$41,689</u>	

Eliminate

Coil Blocks	3-001	1,222	-0-	1,222	100
Bellville Washers	4-021	1,331	-0-	1,331	100
Shell Hsg.	4-010	81,803	16,803	65,000	80
				<u>\$67,553</u>	

SUB-TOTAL \$633,385

C. Major Engineering or Drafting Change

Change Design, Process and Vendor

Control Cabinet	1-411	56,800	15,980	\$40,820	72
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TOTAL \$1,160,000

ANALYSIS OF CHANGES----REARRANGED TO SHOW

1. The effect on vendors
2. The effect on other departments of General Electric
3. The effect on the other areas of the Power Transformer Department
4. The effect on the Regulator manufacturing section
5. Various opportunities for reducing non-contributing overhead, administrative and other costs.

<u>Source of Supply and Source of Supply Changes</u>	<u>No. of Items</u>	<u>Costs At Start</u>	<u>Costs At End</u>	<u>Decreased Cost</u>	<u>% Decrease</u>
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Purchased Items

1-1. From Outside Vendors

Still outside vendor	37	\$788,295	\$570,153	\$218,142	27%
<u>To</u> combination of out- side vendor & "make"	1	6,045	1,511	4,534	75
<u>To</u> "eliminate"	6	5,712	-0-	5,712	100
		<u>\$800,052</u>	<u>\$571,664</u>	<u>\$228,388</u>	

Purchased Items

2-1. From Distribution Transformer Dept.

Still Dist. Transf.	5	62,619	22,564	40,055	64
<u>To</u> outside vendor	(1	81,804	16,803	65,001	79
	(*	*	*	366,804	

*In this case, we only have the figures on the difference of \$366,800

<u>To</u> "eliminate"	1	4,067	-0-	4,067	100
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2-2. From Distribution Transformer Dept. and "make"

<u>To</u> outside vendor	1	56,800	15,980	40,820	72
				<u>\$516,747</u>	

Purchased Items

3-1. From Power Transformer Dept. Tank Shop

Still PT Tank Shop	2	30,151	19,035	11,116	37
<u>To</u> outside vendor	9	124,565	34,907	89,658	72
<u>To</u> "eliminate"	2	2,609	-0-	2,609	100

<u>Source of Supply and Source of Supply Changes</u>	<u>No. of Items</u>	<u>Costs At Start</u>	<u>Costs At End</u>	<u>Decreased Cost</u>	<u>% Decrease</u>
To "make"	1	\$ 3,114	\$ 779	\$ 2,335	75
3-2. From Power Transf. Dept. Tank Shop and outside vendor					
<u>To outside vendor and "eliminate"</u>	1	2,120	846	1,274	60
3-3. From Power Transf. Dept. Tank Shop and "make"					
<u>To outside vendor</u>	1	31,913	17,038	14,875	46
		<u>\$194,472</u>	<u>\$ 72,605</u>	<u>\$121,867</u>	
<u>Purchased Items</u>					
3-4. From Power Transformer Dept. Internal Components Section					
Still PT IC Section	1	1,085	165	920	84
<u>To "eliminate"</u>	2	9,588	-0-	9,588	100
To "make"	1	8,836	987	7,849	89
		<u>\$ 19,509</u>	<u>\$ 1,152</u>	<u>\$ 18,357</u>	
<u>Changes in Own Section</u>					
4-1. From Make in Own Section					
Still make in own sect.	5	20,820	5,034	15,786	75
<u>To outside vendor</u>	5	24,253	9,280	14,973	61
<u>To "eliminate"</u>	1	75,469	-0-	75,469	100
<u>To various</u>	2	22,044	15,746	6,298	28
4-2. Make in own section and outside vendor					
<u>To various</u>	14	94,176	38,802	55,374	58
		<u>\$236,762</u>	<u>\$ 68,862</u>	<u>\$167,900</u>	
<u>Various Improvements</u>					
5-1. Various to various	10	143,081	76,580	66,501	46
				<u>*\$1,119,700</u>	

*The original figure was \$1,119,000, but more recent adjustments have now increased it to \$1,163,000

HOW THE CHANGES WERE ACCOMPLISHED

1. Section manager Butler told S. Hvamb, Value Service Manager of Value Control and H. Mullins, Value Service Consultant, Value Analysis and Control Practices, what he needed and asked them how to accomplish it.
2. Engineering manager W. A. Williams was selected as manager of two concurrent task forces...
 - a. The identification of unnecessary cost, value alternatives, and selection decisions
 - b. The implementation of the selected value alternatives.
3. A meaningful costs system, necessary for value measurement and analysis, was developed by the section management. Costs 1 through 5a - totaling 72.8% of cost - were selected and were always used.

Cost Make-Up On Voltage Regulator

<u>Item</u>	<u>%</u>	<u>Description</u>
1	42.1%	Direct material
2	9.5%	Direct labor
3	11.1%	Applied IME
4	9.1%	Period - IME, losses, variances
5	(6.1%)	Engineering and complaint
a.	1. %	Complaint
b.	5.1%	Engineering
6	4.3%	Box, pack, ship - transportation
7	10.9%	Marketing costs
8	6.9%	Other assessed functions

4. For decision-making, these value measurement costs and the traditional incremental costs were both used. All items of savings qualified on an incremental basis excepting \$9700.
5. Every necessary action, including management decision making, was assigned schedule dates.
6. To the extent possible in two months...

Marketing concepts were improved.
 Design concepts were improved.
 Design detail was improved.
 Manufacturing processes were improved.
 Purchasing was improved.
 Functions were identified.
 Functions were evaluated.
 Temporary value standards were developed.

Tangible alternatives were developed.
The most appropriate alternatives and sources of supply were selected.
Decisions were made and actions taken to have the resulting improvements
in effect in the production line during the last quarter of 1961.

7. Costs of operating the Value Task Force. . . .

Out of pocket cost - (largely identification cost)	\$6,000
Facilities, consultants, communication expense, sample work	

Salaries of engineers and others who would have worked on the Regulator
even in absence of the task forces during this period were not
extra expense and, accordingly, are not included in these out-
of-pocket or implementation costs.

Implementation Cost

Additional samples and tooling	60,000
Extra cost to have in use by last quarter 1961	
a. Additional drafting expense	7,500
b. Probable special expediting expense	(approx. 12,000)

Some items are continuously being put into production so that
substantial savings will be realized before the October date.