FRIGIDAIRE'S DISRUPTION FREE PRODUCTION: A CASE STUDY

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Abstract

This case study deals with the implementation of Disruption Free Production (DFP), as part of continuous improvement efforts, at Frigidaire's Greenville plant. In the past, DFP has been successful in increasing efficiency with little or no capital at the Anderson plant of Frigidaire. This case study can serve as a good vehicle for discussing the elements of DFP, the loss in failing to do so, and the practicalities of implementing DFP.

Introduction

In recent year the concept of continuous improvement (CI) has been emphasized by an increasing number of companies through the world. CI has been seen as one of the activities whereby processes and procedures are implemented that contribute to organizational goals through the continuous improvement of work processes, work places, and work interactions. This case study illustrates the process of implementation

of Disruption Free Production (DFP) at Frigidaire's Greenville facility. DFP was implemented at Frigidaire as part of its ongoing continuous improvement efforts.

In late July of 1998, Bill Topper had just returned to Frigidaire in Greenville, this time as the VP of operations. His job was to continue and accelerate recent gains in the profitability of the facility. Frigidaire, Greenville had recently begun to gain market share mainly at the expense of General Electric and Amana. There was no question that General Electric, in particular would fight to get it back, most likely in the form of price reductions. Refrigerator prices had remained stagnant in recent years in spite of rising material and labor costs and starting in late 1996 the refrigerator industry actually became deflationary. Bob Cook, the President of Frigidaire Home Products, had made it clear that Frigidaire intended to hold the recent gains in market share at any cost (or price point). As Bill Topper put it, "Once General Electric gets used to having 15% market share and us 25% we'll all get along." Bill was convinced that material and labor costs would continue to rise. In addition, there were other problems that needed immediate attention at the Greenville facility. Inventory levels were too high, the management force was disorganized and fat, there were glaring inefficiencies at the factory levels, and numerous design flaws in the high end Line 5 product. And worst of all, in spite of the high inventory levels, the factory was not fulfilling its mission statement of "Deliver on time, in less time."

Certain these factors could be overcome, Bill set out to change the culture at the Greenville facility. He had a history of accomplishing things that the rational person would believe to be impossible. He began his career at Frigidaire as a welder right out of high-school. Not lacking in ambition, while still a welder, he claimed that one-day he would "run this company." He worked his way into the position of quality manager then to the operations manager of Line 5. In 1997 he was promoted to plant manager of the laundry plant in Webster City, IA where he worked until July of 1998 when he returned to Greenville as VP of operations. The question wasn't *whether* Frigidaire could continue to compete with General Electric and Whirlpool but rather what was the quickest way to transform the facility into a more flexible, efficient and profitable site. In the early years

Bill had managed to obtain results by being an almost ruthless dictator, accepting nothing less than perfection from his subordinates. Later, though as plant manger and VP of Operations at the laundry facility, and under the tutelage of Bob Cook, Bill had learned the power of having an effective *system* to not only implement but to solidify change. He believed that a culture change would have to take place within the facility, which would no longer tolerate mediocrity and the repetition of the same mistakes but one that would embrace continuous improvement.

The Anderson SC facility had shown impressive results with a continuous improvement program called Disruption Free Production (DFP). The system was touted as dramatically increasing efficiency with little or no additional capital. With successes in Anderson SC and elsewhere to draw on, Bill Topper vigorously pursued the implementation of DFP to the Greenville facility.

Background

Company

Frigidaire is part of the AB Electrolux global appliance company. With sales in excess of $15 billion, AB Electrolux is one of the world's largest manufacturer of home appliances such as refrigerators, washing machines, stoves, vacuum cleaners and room air conditioners as well as outdoor products such as lawn movers, garden tractors and chain saws. In North America, Frigidaire Home Products represent AB Electrolux. Under this group is the Eureka Company, maker of central vacuum systems; American Yard Products sells under the Sears Craftsman, Poulan, Weed Eater, Husqvarna and other brand names. Frigidaire is the name under which the home appliances are manufactured. Refrigerators are built in Greenville MI and Anderson SC, laundry products in Webster City, IA, dishwashers in Kinston NC, air conditioners in Edison NJ, and ranges in Springfield TN. A schematic diagram of some of the groups in FHP is shown in Figure 1along with a general organization chart for Greenville.

Frigidaire, Greenville was born in 1908 when Frank S. Gibson purchased a furniture company and started manufacturing iceboxes. By 1931 it was the world's largest manufacturer of electric refrigerators. Until the 1960's the name Frigidaire was synonymous with the word refrigerator. Over time, however, other companies took market share from Frigidaire by producing higher quality products, forming niche markets, and reducing costs. For the last 15 or 20 years Frigidaire has solidly held the lead in market share for the low-end, small apartment sized top mounts. In an effort to break into a more lucrative market the Greenville facility added an additional assembly line, Line 5, to specialize in the production of side by side refrigerators. The launch of Line 5 in 1992 was very costly to Frigidaire. Numerous design flaws caused excessive service complaints and poor manufacturability that led to back-orders and excess inventory.

Line 5 refrigerators, side by sides, are far more complex than the traditional top-freezer models like is built on Line 3. Besides being larger and having more features, most all side by sides have an ice and water dispensing system which delivers ice, both crushed and cubed, and water through the door. The Frigidaire side by side refrigerators were designed with cosmetics in mind as opposed to reliability. The actuator that activates the delivery of ice or water was designed significantly differently than the rest of the industry to give a softer look. The problem with the design was that when the customers dispensed ice into a full glass of cola or other sugary liquid, the subsequent splash-off would eventually build up on the switch just behind the actuator and cause the actuator to begin to stick. This would eventually result in a service call as the customer could not always figure out how to make the water or ice delivery stop. Other ice and water dispensing system service issues included selector knobs that would stick, low ice-harvest, water leaks, and slow water dispense times.

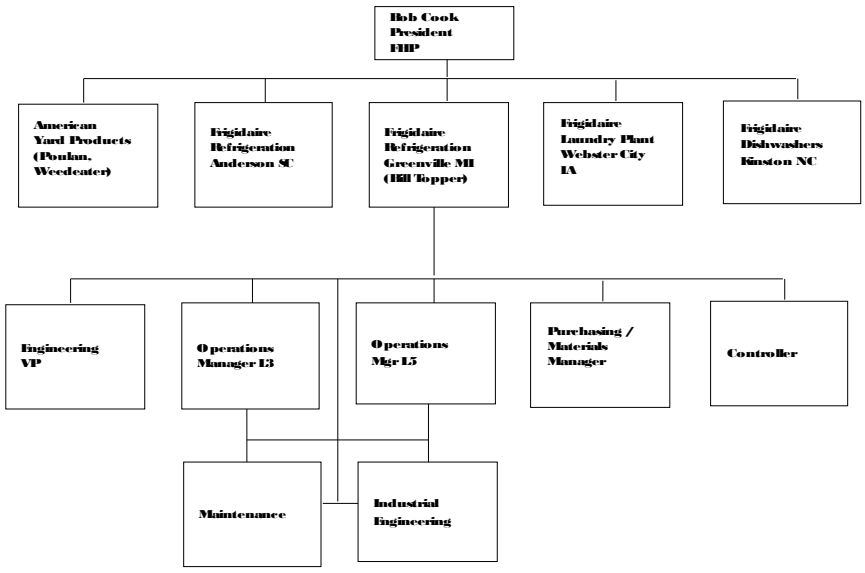


Figure 1: Schematic ofFHP and Greenville.

Manufacturing had difficulties in assembling many of the components. Some of the handle styles, for example, had fifteen different parts. Aside from the difficulty of putting the parts together, the assembly line would then have to use shims to adjust the fit of the handle.

Another manufacturing problem was that the doors were designed without any reinforcement, which resulted in the doors twisting after the foaming operation. Manufacturing would then be forced to find ways to straighten the doors or ways to make the door gasket reach the cabinet.

The first real significant success story for the line finally occurred in 1996 when Frigidaire introduced the Puresource® Water filtration system, the first of its kind in the market place. While this feature allowed Frigidaire to again sell their high-end product to Sears, there were still disturbing quality issues that have only recently been addressed. The maximum running rate for Line 5 was defined at implementation of 900 units per 8-hour shift. Except for a brief period in 1998, Line 5 has run only one shift per day, resulting in the excess capacity.

In 1988 an assembly line was built in Anderson SC to duplicate production of the low-end top mounts similar to Line 3 in Greenville. While both are Frigidaire companies and the organization attempts to instill an attitude of teamwork between the two facilities, in many ways the two are in competition with each other. It is relatively simple to compare the two facilities on cost, the number of service calls and delivery performance because the two products are so similar to the end user. From a manufacturing stand point there are some differences. The plant in Anderson SC runs three shifts on one production line, Greenville runs only one shift on each of the two production lines. Anderson also enjoys the benefits of non-union labor. In Anderson, they only produce small top-mounts with a total of three cabinet sizes. Line 5 in Greenville builds seven cabinet sizes today down from nine three years ago. In addition, the bill for service issues on Line 5 caused the Greenville facility to be a significant burden to its parent company, AB Electrolux. During the years of 1995 and 1996 there were frequent comparisons between the Greenville facility and its Anderson SC counterpart. The future of the Greenville facility was uncertain. Several key meetings with top management within AB Electrolux came very close to closing the plant. Looking back, it seems to be the successful introduction of the water filter, which saved the plant from closing. It was a design the customer wanted and the Greenville facility provided it a full year before the competition. It was a redeeming ray of light penetrating through ocean of negative results. It represented hope that someday Frigidaire, Greenville might be able to compete for market share in the more lucrative side by side market.

The majority of volume for refrigerators for Frigidaire comes from the smaller static-condenser models. Static-condenser models are often referred to as “dirty-back” models due to unsightly appearance of the dirty condenser easily visible on the back of the refrigerator. However, the simplicity of the design reduces cost and service complaints. Though this is a low-margin product Frigidaire builds it very efficiently and has formed sort of an unlikely niche market with it. In Greenville, the 15.5 cubic foot and 20.6 cubic foot refrigerators are produced on Line 3, a production line completed in 1982. At the Anderson, SC plant they build 13, 15, and 18 cubic foot models.

The Culture

Frigidaire, Greenville is a small community within a small town. By far the largest industry in the town, Frigidaire is an important part of the local culture. However, the majority of the employees live in communities just outside of Greenville and have, over the years, formed a culture at Frigidaire based on tradition and history. Entwined invisibly within the hierarchical flow chart of the company exists the genealogical lines between husbands, wives, ex-husbands and ex-wives, children, step-children, cousins, and in-laws through all reaches of the organization. At retirement luncheons, retirees shake hands with their high-school buddies who are sticking around to work another day. The expiration of contracts tear at the heart-strings of families and friends as they sit on opposite sides of the bargaining table. More than most companies, Frigidaire, Greenville is a company employed by a mostly homogenous cross-section of an already homogenous local population.

Decisions at the local level, whether in the factory or in the offices were historically based on tribal knowledge and personal relationships. Common explanations for irrational behavior were, "we've always done it that way," and "They [with a capital T] told us to." Once the facility became ISO 9000 compliant in 1996 the "They [with a capital T] told us to" excuse was largely eradicated. The "we've always done it that way" explanation had the impact of repeating the same mistakes and would require a culture change seeking continuous improvement before it could be eliminated.

In spite of the apparent burden of being unionized the Greenville labor force is surprisingly flexible. In one period of high demand for sales, the Greenville facility drew the attention of all of FHP by working two consecutive weekends without adverse consequences. In all, the work force worked for nineteen days before having a day off. Management had explained the importance of meeting the unexpected surge in demand as a result of Sears switching sales to Frigidaire from General Electric. The opportunity existed for the union to take an active and crucial role in the very real battle with the competition. When the information has been given freely to the union and the business

case for change has been clearly justified, the union has seldom, if ever, rejected worthy projects.

An Overview of Line 5

As shown in Figure 2 the birth of a refrigerator on Line 5 begins in D224 with a coil of . 017" steel. The prepainted coil of steel is uncoiled, slit and notched. The notched blank is then roll formed and attached with the rear panel and base inside a series of automated equipment. The equipment in this area is a headache to the tooling department due to the amount of maintenance required and the amount of emergency service calls they have to make. To prevent the line from stopping every time a problem occurs in this department there is an upstream bank which holds 180 cabinets. From here the cabinet shell enters D225 where it is prepped for foaming. Here, the polystyrene liners are installed along with numerous screw anchors, pieces of foam tape, plug buttons, and other miscellaneous parts. A 2nd bank for prepped units that holds about 144 units exists after D225. This serves as a further buffer against breakdowns in D224 as well as problems that might occur in foaming department, D226.

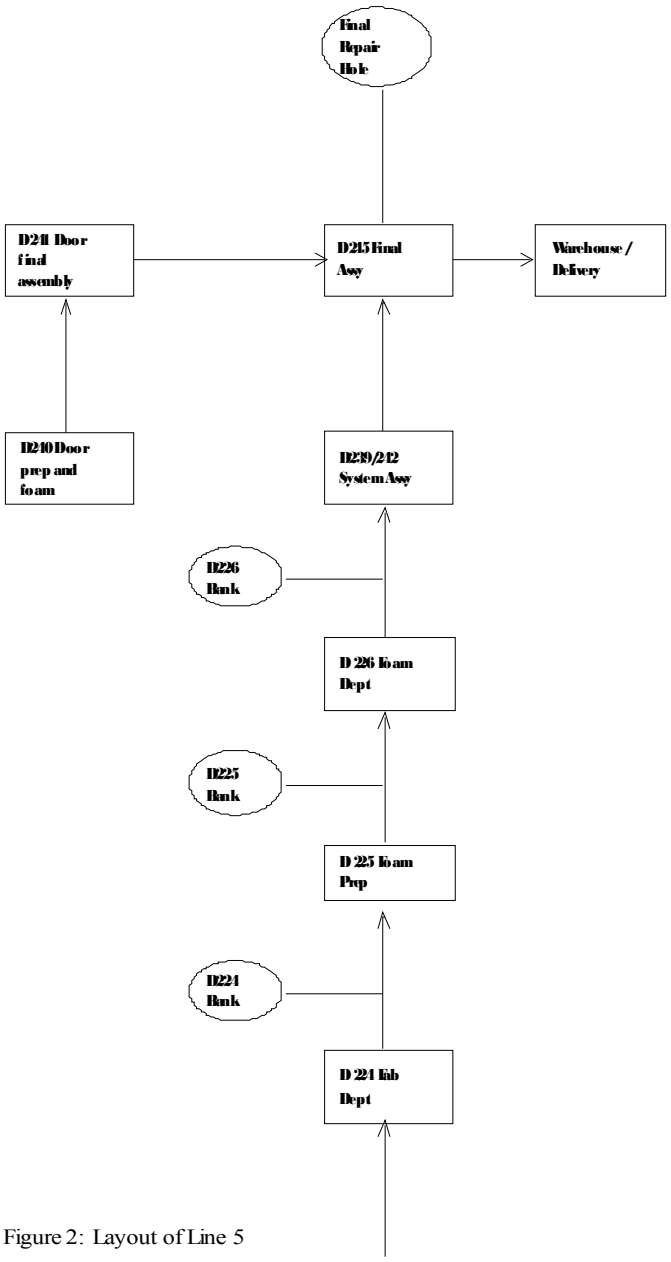


Figure 2: Layout of Line 5

Before the foaming process the cabinet is a flimsy structure of sheet steel with plastic liners installed. The foaming process injects high-pressure foam between the liners and the cabinet to give the refrigerator structure and thermal insulation. There are 16 foaming fixtures and each has a cure time of several minutes, creating a bottleneck for the assembly line. To compensate for the bottleneck a 2nd shift skeleton crew is required to fill a bank immediately after foam of about 500 units. This is the last bank on the

assembly line (ignoring the final repair hole). From the bank of D226 the foamed cabinet goes to D239 and then to D245 where the system (the compressor, evaporator, refrigerant and controls) and the features (crispers, shelves, bins, racks, doors) are installed. Before entering the bander for shipment to the warehouse, about 15% of the units will wind up in the final repair hole that holds 400 units.

DISRUPTION FREE PRODUCTION (DFP)

Elements

The key concepts of DFP are:

- All processes must directly serve the customer.
- Eliminate functional barriers that hinder service to customers.
- Improvements are made with little or no capital investment. Under DFP, the conventional answer to fix problems with new technology or new equipment is seldom accepted without serious scrutiny. The idea is to first do things "perfectly" every time. Whenever disruptions or shortages occur, they are tracked and recorded.
- Gather data on all processes. Do not be guided by opinions or hunches.
- Total elimination of waste. Like most modern manufacturing philosophies, a core practice in DFP is the location and removal of waste. DFP defines waste as anything that the customer is not willing to pay for. The customer is willing to pay for the installation of the door to the refrigerator but is unwilling to pay to have people take the door to storage, find the door later, and bring the door to the line for assembly. Since someone has to pay for this waste and the customer is unwilling to do so, the shareholder ultimately pays the price. DFP strives to eliminate this need.
- Teach work teams to identify disruptions and improve their own processes using quantitative measures and qualitative judgments.
- Allow production to be *pulled* by customer orders (rather than pushed by internal factors)
- Reduce inventory to an absolute minimum – make to order wherever possible
- The FHP goal is to deliver on time in less time or DOT ILT.

- Capacity: Disregard conventional wisdom. Never let capacity limit potential. The difference between "maximum" capacity and actual production is caused by disruptions that are tracked and eliminated.
- Following Established Procedures. "If management cannot get people to follow the established procedures, nothing else it does will matter." DFP also proclaims that it is better to follow a flawed system perfectly than to not follow it when it breaks down. As the expectation failure modes of processes and systems are defined and measured new and better methods will be developed. As these new ways are developed, procedural changes must be made and adhered to.

DFP, formerly known as Disruption Free Production, and recently renamed Disruption Free Performance began in the Frigidaire Anderson SC refrigeration facility as a tool to compare expectations with actual performance in the factory. In spite of the many keys listed above the idea is to simply measure the amount of units produced from any given department and compare that with the number of units that could have been produced under disruption-free conditions. The difference between the potential and actual output represents lost units. Under DFP each lost unit is recorded and assigned a reason code. These lost units are defined as *opportunities* for improvement. The idea is that DFP forces resolution to the issue, it forces the workforce to find the root cause and attempt to eliminate it from occurring again. At weekly meetings each department explains the causes for all lost units during the week and presents action items to eliminate repetition of the lost unit. All action items must have at least one person responsible and a corresponding target completion date. Bob Cook, the president of FHP said, "If you give me a project without a date you're not giving me a project. You're giving me a dream." The statuses of all ongoing projects are reviewed at the weekly meetings and the results of each completed project can be seen from plots of historic data. Figure 3 shows an actual DFP tracking sheet with persons assigned along with the measurable objectives and results.

These weekly meetings begin fifteen minutes after the shift is over, after most of the people have been working for over nine hours. There is no overtime paid to anyone for

attending the meetings. The meetings can last for as long as three hours but typically last for about an hour. Sometimes the criticism for misdiagnosing a problem, failing to take appropriate action or failing to meet a date can be severe. The meetings are often dreaded and never does anyone look forward to attending them. In spite of this, all of the facilitators agree that DFP works. The measuring of lost units, citing the reason, assigning a person to eliminate the disruption from occurring, giving a corresponding date and reporting weekly on the progress of the project make it impossible to ignore a disruption.

FRIGIDAIRE HOME PRODUCTS																	
				Telephone:			Date Issued:										
DFP	Activity	Unit of	Bi-	Start Date			Action Plan Dates / Improvement Attained										End Target
Action Plan	A	Measure	Wkly	10/10	10/31	11/7	11/14	11/21	11/28	12/5	12/12	12/19	12/25	1/9	1/16		
PROBLEM: FOAM HEADS DRIFTING		DT	Target		50	50	50	50	50	0	0	0	0	0	0		
		PBS	Actual		401	317	333	207	112	0	0	0	0	0	0		
Stopped tracking 1/16					46516	36772	38628	24012	12992								
		Responsible			HORIZONTAL BAR GRAPH TO COVER TIME FRAMES OF ACTION PLAN												Impact to other dept.
REPLACE COMPUTER PROGRAM IN FOAM BOOTH					83288	75400	62640	37004	12992								
REPLACE ALL SERVO MOTORS		STEVE STAFFORD										COMPLETE					
SO HEADS QUIT DRIFTING		HARRY BIGLER															
ALL WAS INSTALLED OVER THANKSGIVING																	
WEEKEND (COMPLETE) 11/26/98 RUNNING WITH NO PROBLEMS																	

Figure 3: DFP sheet for a successful project to reduce lost units caused by equipment malfunction.

An example of a long-time problem that was ignored pre-DFP was the requirement to have an inspector buy-off a pierced door blank after a changeover before production could begin. On some occasions the inspector would be involved in another issue and would be unable to immediately buy off the door. Meanwhile the door fabrication line would remain idle. When this area was brought under DFP 130 units were lost one day. This was not the first time this had happened but there had previously been no system in place to force a conversation as to how to prevent it from happening again. A person was assigned as a leader and an implementation date was set. As a result

a go/no-go gauge was built which could be used by the operator, thereby eliminating the need to ever have an inspector do that job.

Evaluating the performance of facilitators and department managers in such a cut and dry fashion encourages the enlistment of ideas from the operators. Operators and line-workers are seldom short of ideas on how to improve processes or design but these ideas sometimes lack sound business judgment. This fact can create a certain arrogance within management that can prevent the implementation of good ideas from the people closest to the process. In Greenville that arrogance is quickly erased at the first DFP meeting where the goal is constantly made very clear – eliminate lost units. During one DFP meeting some of the line workers were solicited for ideas. One worker suggested a way to improve changeover time. On Line 3 where there are only two cabinet sizes, one of the rollover stations had to be adjusted with knobs and gears each changeover. The suggestion was made to replace the existing system with one that only required two levers to be pulled setting the station into one of two discrete locations, one for each cabinet size. This reduced the changeover time at that station from about five minutes to a matter of seconds.

The collection of data allows Manufacturing to easily make the business case for purchasing new equipment or upgrading existing equipment. Management is often suspicious of the all-too-automatic response of manufacturing personnel for new equipment as the answer to problems. However, when the business case can be made properly and with clarity, new equipment can be purchased. When the proper business case is not made and the request is denied, manufacturing personnel often become frustrated, knowing that the idea is worth pursuing and believing that no one “at the top” will listen. Requiring lost units to be tracked makes it easy to make a business case. As team members began using DFP data to justify investment requests, an accurate estimation of a cost per lost unit needed to be determined. Accounting was tasked with this job and gave the cost at $116 per lost unit on Line 3.

One of the most confounding problems in refrigerator manufacturing is the foaming operation of the cabinet and doors. The foam gives the cabinet and doors the majority of their structural, dimensional and insulation properties. Humidity, barometric pressure, temperature, cure time and countless other variations in the process have an impact on the aforementioned properties of the finished product. The foam process is the true bottleneck of refrigerator manufacture due to the inflexibility and length of the cure-time of the foam. It is this fact that makes further disruptions in this process so costly.

During the foaming operation of Line 3 doors, foaming heads had a tendency to drift "off home" causing the pour booth be shut down so the heads could be reset. A request had been made in 1997 to upgrade the computer equipment which regulated the foaming heads precision., however the request was denied. Later, armed with DFP information and the $116 figure for lost units, manufacturing easily won the approval for $90,000 to upgrade the computer equipment for the foaming heads. Refer back to Figure 1 to see the DFP sheet for this project. Figure 4 shows the lost units for this problem base on DFP data. In Thanksgiving of 1998 the project was complete and the lost units for that cause was reduced to zero. The equipment paid for itself in less than two weeks.

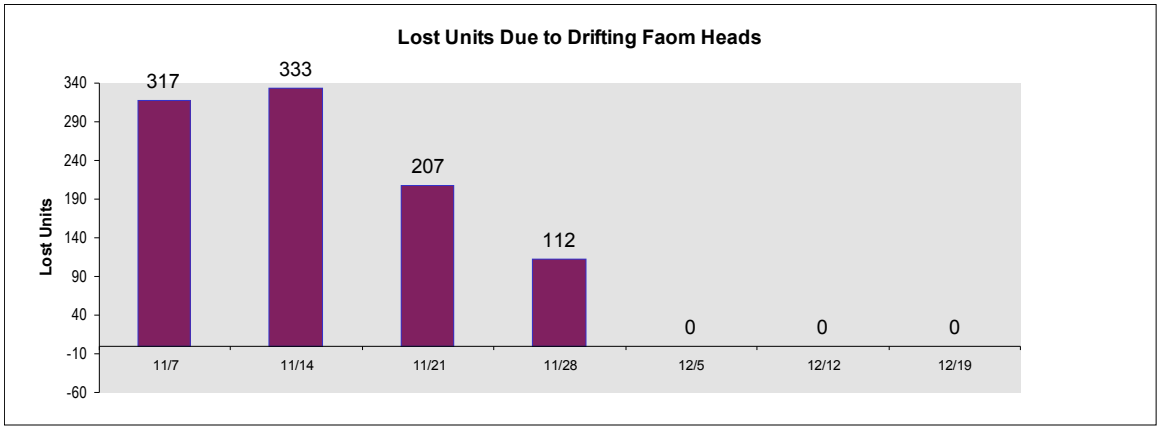
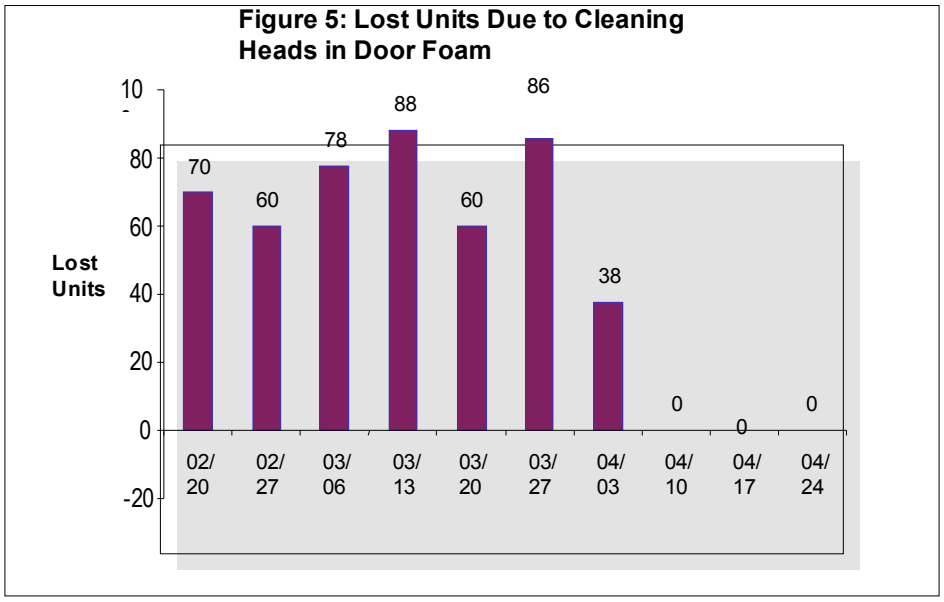


Figure 4: Lost Units Due to Drifting Foam Heads

In the two weeks before Thanksgiving motors began to be replaced. Over the

holidays the program was completed thereby eliminating lost units caused by drifting foam heads. There hasn't been another unit lost since.

Simply having a forum where all areas of the organization can come together and discuss problems often inspires impromptu brainstorming sessions where viable solutions are obtained. Upon seeing a relatively flat trend line on lost units due to cleaning foam heads on the door line the question was raised what could be done. The reason for the lost units was that the line fixture had to be shut down for the fixtures to be cleaned. The



idea of a using a spray gun so that the fixture would not have to be shut down was suggested, discussed and in two months the project was complete. Figure 5 shows the DFP data before and after project completion.

DFP and the Bottom Line

"On our side by side refrigerator line in 1998 it was believed our maximum line rate was 1550 units per shift. That, we believed, was a huge success over our last side by side line's capability prior to Line 5 which was 1200 units per shift. After utilizing DFP

now in 1999 we have accomplished much in a short while. In January we achieved 1695, February, 1705 and by February month end we are at 1766 units per shift. Our smaller top mount line's maximum line speed was 1650 units per shift, and is currently 2300. DFP works." - Bill Topper, March 1, 1999.

As of December 1999, Line 5 has accomplished 2100 units per shift and Line 3 has run 2800. During the peak selling periods of 1998, both lines in Greenville had to run two shifts with production on Line 5 of 900 units per shift for 1,800 per day and Line 3 with 1,200 per shift for 2,400 per day. The ability to run at these rates on single shifts eliminated the need for the addition of 2nd shifts on either line in spite of higher sales than in 1998. This increased efficiency reduced the variable costs of the product, erased conventional wisdom about capacity and reduced finished goods inventory.

DFP –its limitations.

There is some inconsistency with the use of DFP throughout the different plants in FHP. The DFP manual cites the importance and uses of ANDON boards. Even though the Greenville facility had ANDON boards installed in 1995, they are not being used today. SPC as a process control is also a staple ingredient for DFP that is also neglected at Greenville. The reality is that since DFP is used in at least seven different plants, it has evolved differently for better or for worse at each facility.

Though no one denies the impact DFP has had on manufacturing, material handling, and warehouse departments; Frigidaire cannot compare itself to, say, Toyota. As Frigidaire congratulates itself on reducing inventory by negotiating with Sears to obtain a three-week lead-time for a specific mass-produced model, Toyota promises a five-day lead-time for a custom-made automobile. DFP has no mechanism or particular emphasis on the supplier relations necessary to accomplish such a task. Frigidaire, Greenville is constantly creating disruptions as a result of supplier changes or problem suppliers. Supplier disruptions at Frigidaire are typically handled by pitting one supplier against the other or by punishing the supplier with stiff penalties for mistakes. To date

there have been few, if any, initiatives where FHP has worked closely with any one supplier to improve the processes in a mutually beneficial, long term manner.

Engineering involvement with DFP is limited to bill of material corrections and design changes to reduce disruptions. Though there is a heightened engineering involvement in eliminating disruptions on the factory floor there has been no change in the engineering philosophy in the design process as a result of DFP. At a time when the engineering department is divided into two divisions, one supporting manufacturing and one designing the next generation of refrigerators, the next generation designers have little if any exposure to DFP.

Poor quality can slip through DFP. At Greenville, when a problem exists at the factory level ANDON lights do not stop the assembly line. The idea of stopping the line and having a pow-wow to figure out why the doors are not perfectly straight is not one of great merit at Greenville. After all, the doors are formed two days ahead of time and foamed one day ahead of time. Waiting for perfect doors would be too costly. The problem is that DFP only tracks lost units. If production is not stopped, then the problem of twisted doors produces no lost units. If the units are sent to the warehouse the only way DFP can track the problem is if there is a rework. However, if the problem is one where no rework is feasible, it will be invisible to DFP. Therefore, quality problems that do not generate lost units can exist quite happily within DFP. Within the DFP operating philosophy is an underlying assumption of ". . . without compromising quality" However, unlike TPS there is no built-in function which will actually improve quality. The fact that DFP does not have this feature does not mean that quality improvements are not being carried out at Greenville. On the contrary, recent improvements have reduced the service complaints on some models of the high-margin Line 5 side by sides by a factor of three while Line 3 service call data is also dropping. These changes were mainly a result of the correction of design flaws due to the increased pressure from Sears.

Conclusion

Frigidaire created DFP for itself. It is not all encompassing but there are signs that might suggest it is heading in that direction. The recent name change from Disruption Free Production to Disruption Free Performance represents the evolutionary aspect of the program.

Proponents of DFP point to the successes of other companies such as Toyota and Coca-Cola in an attempt to inform the workforce on what is possible and where Frigidaire could someday be. On the Frigidaire Intranet sight, articles on lean manufacturing, TPS, ERP and DFP are posted to heighten awareness of these other programs and to encourage the melding of aspects of these plans within the different FHP plants. Two years ago, before the accomplishments of DFP, an article about Toyota prefaced with the comment, "Imagine Frigidaire building a refrigerator to order in 5 days!" would have been met with hysterical cynicism. Number two in market share seemed unattainable until recently. It is conceivable that soon Frigidaire could be fighting for the number one position.

The competitive market has forced Frigidaire to reduce inventory, cut costs and improve the serviceability of the product. These accomplishments over the last two years have resulted in substantial increases in profits over this time period. Though there are still improvements to be made in all of these areas, the costs associated with the amount of lost units far exceeded all the other costs combined in 1999. For Greenville to continue to improve, the greatest opportunity lies in further exploiting DFP to reduce lost units.