Ge cafe refrigerator filter replacement instructions

Fifty miles south of Nashville, outside the city of Columbia, where restaurants offer Bar-B-zee and cata, is hardly a piece of America's chimney. There, located among the pine and hardwoods of rural Tennessee, is one of the most automated plants in the world. Had it not been built, American households could soon have had another product - a refrigerator with a seal made in Japan. Instead, here in the heart of the country, General Electric has found a way to build products better and cheaper than those made by foreign workers paid one-tenth of the American wage. It wasn't easy, but GE's struggle shows the challenges the United States must and can face if it wants to regain leadership in global manufacturing. Tom Blunt still remembers the day in 1979 that he first entered Building 4, a factory in Louisville, Kentucky, where compressors for GE refrigerators were made. The compressor - the pump that creates cold air - is by far the most expensive part of the product. It is also the heart of the refrigerator, just as important as the engine in the car. You would never have guessed that by looking at Building 4. The factory was loud, dirty, built on the technology of the 1950s: old grinding machines, old furnaces, too many people. Finishing one piston took 220 steps. Even the simplest functions had to be done manually. Workers loaded cars, unloaded cars, transported parts from one car to another. The scrap level was ten times higher than it should have been; 30% of everything the plant did was thrown away. There was only one thing Blunt liked about Building 4. He liked the idea of defeating him, changing it, restoring it. But it wasn't his place to suggest that. He has only recently joined ge's Major Appliance Business Group (MABG) as Chief Range Manufacturing Engineer. It was too new to start pushing for big projects, especially projects in someone else's department. He also thought that management would never pour huge dollars into the remodeling of the whole factory. He realized that MABG prefers cosmetics - bells and whistles - to engineering. In Louisville, money was all on the marketing side. Over the next 18 months, however, others at GE also began to worry about building the 4. A series of warning signs began to wake Up Louisville. The group's profits were off. Market share was falling. Competitors pushed several fronts. Matsushita has been producing better, cheaper compressors in Singapore, and selling them to Canadian subsidiary GE. Mitsubishi experimented with rotary compressors, a technology that GE invented but used only in its air conditioners. Most worryingly, Whirlpool, GE's main competitor, will move the production of compressors to While Louisville was focused on bells and whistles, Whirlpool looked abroad, saw the future, and acted. Then, the threat even got Home. In the fall of 1981, both Matsushita and Necchi, an Italian manufacturer, approached MABG itself by offering lower priced compressors that were really fine machines. If this had happened ten years ago, there would have been one answer: to fight back. No one would have thought about buying from competitors. Even whispering the word search would be sacrilege. MABG is manufactured at home in the United States. His factories were unequal. But things have changed. Now many in Louisville have begun to wonder whether Japan can be their deliverance. People started talking about a new strategy - search. Tom Blunt didn't appreciate such conversations. To date, he has been appointed head of advanced refrigerator manufacturing, MABG's largest product. Little put him in a worse mood than the decision to close the plant. Sourcing makes sense in some circumstances, he says, but you can't source everything. My instinct is always - always to do things. Colleagues told him it was time to face the truth: there are certain areas, certain products, in which the United States can no longer compete. Bull, he said. All we have to do is find a way to make it faster, cheaper, better. John Truscott, MABG's chief engineer, agreed. The compressor is the heart of the fridge, he says. The fridge is the heart of this group. I didn't want to give our heart away actually, no one was willing to go that far yet. Sourcing was a compelling idea, but it is still new. IABG needed more information. My consulting firm was asked to provide it. I discovered that Matsushita had built a factory in Singapore that planned to produce millions of low-cost compressors for reciprocal communications for global markets. Both Toshiba and Mitsubishi made rotary compressors that were cheaper, quieter and more efficient than the reciprocal compressors used by all other refrigerator manufacturers. Sanyo also planned to move into rotation. None of this was an accident. Obsessed with exporters, the Japanese have spent the last few years traveling to the United States, probing the home appliances market in search of weakness and finding it. Now they wanted to show off their plants. They knew that GE was considering finding compressors, and they all wanted to sell. Then I went to Italy; Nekki was as big a threat as Japanese manufacturers. Its new compressor plant was much more automated than building 4. Finally, I visited Embraco, a new Whirlpool plant in Brazil. Ge herself was a subsidiary nearby, making refrigerators for the regional market just as it was in Canada. This plant also wanted to buy compressors of a competitor - Embraco. I went back to Louisville and gave my interim report. The numbers were staggering. It cost MABG more than $48 to make each It cost Nekka Necca Mitsubishi $32 to $38. Sanyo, Hitachi and Toshiba are designing factories that will make compressors for less than $30. Singapore's Embraco and Matsushita plant was worth $24 to nearly half of GE's value. One of the reasons was labor. GE paid more than $17 an hour, including benefits compared to Matsushita's $1.70 in Singapore and Embraco's $1.40 in Brazil. Even more striking was the difference in performance. Ge took 65 minutes of labor to make the compressor. It took 48 minutes in Singapore, 35 minutes in Brazil and less than 25 minutes in Japan and Italy. A company that pays higher wages for lower efficiency doesn't stand a good chance. Export competition plans were just as intimidating. Embraco already deliver 10,000 compressors a month to the United States and aims ten times more than in four years. Meanwhile, Nekki has just increased exports to a million a year, and Matsushita will soon be in the multimillion-dollar. Overnight, foreign companies went from a small percentage of the U.S. market to 20%. And the real invasion hasn't started yet. MABG's biggest product was under threat. If the leadership does not act soon, it could be disastrous for the whole group. Options? One possibility is the source. Another project is the construction of a plant abroad in a low-wage country, possibly in a joint venture. The third opportunity is to invest in a new, more efficient plant here at home. It was clear which way Louisville was leaning. If they're so far ahead of us, one executive said, how can we catch up? We should just go to the source, added someone else. Even John Truscott, the head of the engineering group, hesitated, appalled by the difference in labor costs. Most felt it was a shame that GE was being outcompeted and more ashamed to think about closing the plant; but the company's first mission is to survive. Although this was only an initial review, for many it was enough. The search for the bandwagon began to roll. Don Awbrey, the Louisville general manager who was put in charge of the compressor project, decided to accelerate plans to find an option. It was a good idea. Even if GE built a new plant, it would take years to get it up and running. In the meantime, they need a bridge. However, since the sources were persuasive, there was still strong evidence against it. Once you close your factories, you are in danger of being held hostage by your suppliers, many of whom, in this case, were also potential competitors. To source a product, when you're a second-tier manufacturer to start with- like GE did with the microwave - this is one thing. To source the heart of your biggest product when you are the market leader is big risk. The tide in Louisville was moving toward sources, but was that the right direction? The ideal alternative would be to build a new plant in the U.S. that could make cheap enough to undermine those built dollar-per-hour people abroad. Can a country with high wages do it? Theoretically, yes- through automation. But not with the same product design as the competition - in this case, reciprocal compressors. Brazilian Embraco has automated the cliffs as far as possible with low-wage workers. GE's only hope was a new design - rotary. Because it had fewer parts, it seemed like a good chance to make it faster, improve performance. This was what Toshiba plans to do with its rotary. Can MABG do even better on its own? I doubted it. It's hard to become a leader in a new technology that a competitor has already started to work with. They worked the compressor much more complicated. But there was no need to do it alone. If GE can get Toshiba to help with either a joint venture or a technology license, it will have a better chance with fewer gambling. At least it was an alternative. But the proposal for its GE headquarters in Connecticut will take more than rhetoric. A detailed plan will be required to study the rotary option. He wasn't happy to see me. He heard about my interim presentation, and the way the search for the bandwagon is rolling. He is confident that the decision has already been made. But I explained about the rotor and asked if he could make a plan for the plant. He nodded. That's what he did for a living, it wouldn't be a problem. I told him he didn't need to design it from scratch. Instead, GE could work with Toshiba or another Japanese manufacturer. Blunt's answer matched his name. He didn't want to do it that way. If we gave his guys a chance, he said they could beat the Japanese. But he doubted that the leadership would allow them to try. The new plant would not be cheap, and then, it was almost unheard of for an American smoke pipe company to fight foreign competitors with big plant investments. However, he said he wanted to do it, though he didn't think anything would come of it. I agreed to support him. We would offer to build a new plant without the Japanese. John Truscott was also intrigued. Prior to joining Louisville, he pushed the technology forward at every stage of his career, first on the aerospace team involved in breaking the sound barrier and then when he helped improve medical CPR scans. Now he saw the same promise in the task of automating America's chimney. It is time to show that the United States can still be a world leader in manufacturing. Truscott spent some time studying the rotor with the help of an engineering eye. He found that it could actually be easier than old-fashioned reciprocal compressors. He also found that even Toshibas were from perfection. There was a place to take it out of competition. He assembled a team to create a new design. The challenge was to make the compressor as simple as possible, with low noise, high efficiency and, most difficult of all, durability. At the same time, it can't be loaded with too much metal or it will cost too much. After months of work, engineers came up with a model they were convinced could be made cheaper than the one the Japanese produced in Singapore. There was only one problem: the design required key parts to work together at a friction point of fifty million inches - about one hundredth of the width of a human hair. No product on earth has ever been produced en masse with such extreme tolerance. Most engineers thought the technology didn't go far enough, even to try. Tom Blunt knew that some machines were working on these tolerances -- jet engines, for example. But their parts had to be wielded one at a time, for long hours. Was it possible to get such precision at a factory that made 3,000 pumps a day? Everyone they spoke to doubted that it could be done. Design engineers took Truscott's idea anyway. That looks possible, Truscott said. He told Blunt to gather the people needed to plan the factory. Blunt knew he had just traded himself into an obsessive few months. Designing a new plant is extremely difficult work with 100 new headaches a day. But that's why he likes to do it, he says. Because it's hard. Blunt knew it would be the first one of the most automated plants in the world. It will take 40 people to design it. Many ge colleagues advised him to go outside. According to them, to become a pioneer of new technologies, you need to find designers who are already on the verge of technology. But Blunt decided to stay with his people. He collected a lot from an unlikely place -Building 4. We didn't go out and get a bunch of Star Wars,' he said later. Most of these people came from one of the most unimmutated places you've ever seen in your life. Why would he risk it? Blunt is convinced that American industry does not need to hire experts for breakthrough projects. Most experienced engineers can do it, he says. All they need is support and confidence. At MABG, he knew that his people had neither. Some of the engineers here were the brightest people I've ever seen, he recalls. They had degrees coming out of their ears. But they were never allowed to do anything. For years, they have been free to innovate in gadgets, but not in basic manufacturing. This left most engineers deeply ill. What was worse, Blunt said, was that they were treated as second-class citizens. people thought we couldn't walk around and chew gum at the same time. If engineers were to come up with a world-class breakthrough, they had to believe they could do it. So Blunt began with about morale. When the engineers started their work, he spoke cheerfully about them. The reason he pulled them out of Building 4 is because he needs people who know the factories and still believe in them. He was convinced that they could develop a better plant than anyone in Japan or Korea. True, no one has ever built a plant that could massively produce parts of this accuracy or achieve interchangeability of fifty million inches. But none of it mattered. Here in America, in Louisville, they'd be the first. One of Blunt's favorite approaches was to remind his team that few outsiders would understand why they built factories for life. You don't get credit for it, he'd say, even though it's about the hardest thing to do. But that's why they chose him because of the problem. And then he'd deliver a clincher: Anyone can source, he'd say. Gradually his people began to feel more confident than in years. The problem with most production, Blunt felt, was that factories were designed around the products. This time, he and Truscott decided to develop a process and product together, regulating each as they went. They started by moving manufacturing engineers and engineers all over the room apart. Day after day, more and more people crossed the linoleum. Gradually, they completed the pump to the most automated model - stationary rotor van. With less than 20 parts, it was also the easiest. Computer simulation said it would work, but only if the processing goes far beyond everything that the Japanese have done with their plants. To help find a way to do this, Blunt brought in specialists from GE's jet propulsion unit. He brought in computer modeling engineers he met at Ford. He brought in the head of the Swiss Institute of Technology and consultants from the structural dynamics of the research corporation. But they were just for advice. He still relied mostly on his own people, the people of Building 4. Blunt's main rule was never to let someone say it couldn't be done. We thought it was a way to drive our people out of contemporary art, he says. If you say it can't be done, you won't do it. But if you say: We don't care that it was never done, we will be the first, then you have a chance. Slowly, week after week, the plan came along. There weren't big breakthroughs in Eureka, Blunt recalls. It doesn't work that way. It was all a block-and-tackle grunt work. As he expected, there were 100 headaches a day. Constant disappointment. Late nights. Blunt hasn't really liked the job since he came to Louisville. The factory began to form on paper. Every time they finished rough out a new they tap it into the matrix unfolding along the wall of the corridor. The matrix soon took up a quarter block block To continue, they had to find empty offices and expand the paper there. They spent a lot of time just sitting there drinking coffee and looking at it. How to integrate grinding and measurement? Loading and processing the material? They moved through the pages, deciding what to automate and what to do with the workers. And then it was done. But it still doesn't mean anything, Blunt says. It was just a bunch of sheets of paper. Anyone can do it. Now the second stage has come. Can they design machines that would make pieces of paper called? Blunt had another rule. He wanted every piece of equipment in this factory to be American-made. Its stated reason is that it is too difficult to deal with suppliers 12,000 miles away. But there was another reason. He wanted to show that the United States could transcend the world with only its own resources. One of Blunt's chief engineers was Dave Haymedinger. Under his leadership, a team of engineers began negotiations with suppliers of grinding and measuring machines. Sellers will look at the mass production plan of parts with the precision of the jet engine and then they will shake their heads. You can't do that,' said one seller. We think we can, Heimeminger said. Well, the salesman said, it's our equipment, and we don't think he's going to do it. We think we can find a way to get him to do it. Well, said the salesman, okay. We'll sell it to you. But he won't do that. One manufacturer insisted on putting a clause in the sales contract saying buyers were warned they would not be able to get the clearances they had hoped for. He also added a non-return clause. Heimedinger bought the grinder anyway. Blunt's theory of how to get machines to do things they weren't built for was simple enough. We played with them. Jaimedinger and his team began experimenting with combinations that had never been tried. Often people come and ask Blunt why he's worried. MABG is in trouble, they told him. Why play in a new factory? Let's just source and get on with it. Blunt smiles at the memory. I just put my head down and said, well, we're working on a damn thing. The first prototypes of the machines began to deliver parts that the manufacturers said they could not produce. Blunt knew it wasn't definitive proof. Test processing is a good guide, but when you build an unprecedented manufacturing process, the only real test is the plant itself. The first-of-its-kind plant is its own prototype, says Blunt. On the one hand, he believes that this is a welcome risk, a sign of limitless potential. If they could prove that the plant would work, it would mean that they would not break new land. On the other hand, it made for sleepless nights. Until it was and the switch was thrown, there was no way to know whether or not Success. Blunt, however, had two tests he used to assess whether each of the new ideas would work. The one he calls an eye test. If you look into the eyes of an engineer, he explains, you can see if he feels good about something, or whether he's afraid of it. Another test I'll try. If you hear the engineer say: I'll try, he says, you better look very close because he's afraid it's impossible. When they finally finished their plan, no one said: I will try. One thing that made Blunt more nervous than the technical issue was the financial issue. Will this plant make cheaper compressors than anyone else in the world? It was up to me to make those first predictions. Both Blunt and I knew that if they didn't add up, it didn't matter how brilliant the design was. Headquarters can't go ahead with it. There was no getting around the fact that the costs were huge. The plant itself will cost 120 million dollars. And it will take tens of millions more to redesign the refrigerator so that the new compressor will fit it. That would make it one of the largest investments GE has ever made at the plant. It was a lot to play on the hope that GE could produce cheaper goods - with $17 an hour of labor than rival factories pay less than $2. The risk is starting to loom as almost unacceptable. Then GE engineers came up with a way to reduce it. GE had a plant in Columbia, Tennessee, which made air conditioning compressors - rotary models. Instead of going from nothing to a prototype plant in one jump, they could start with adapting the technique already there. This would allow them to move in the rot faster and work on bugs while the new plant is being completed. The numbers on the proposal looked better. Even with tenfold wages, the new plant will still be the lowest cost of a compressor plant on earth. At least on paper. Blunt knew that this was no guarantee that GE's connecticut headquarters would support the proposal. Fairfield feared huge capital investments, especially since GE recently lost money on a failed washing machine plan. How can MABG convince management to invest even more in an even riskier venture? Especially when it can source almost anything? I finished my calculations and called Blunt. He asked me what I thought. So far I haven't come down firmly on both sides. Now I said I weighed the two options carefully and decided to recommend GE invest $120 million. I went to see Don Awbrey, the head of the compressors. After careful discussion, he called his men together and told them he was ready to go with the factory. But he wanted an airtight offer. So did Jim Lehman, the financier who was with GE during the Years. Like all good finance finances he treated the requests as if the money came from his own pocket. At first he doubted. It caused us to overflow the numbers with all possible risk factors. But at last everything seemed to add up. It was then that the completed plan went to Roger Shipka, the new chapter of MABG. In his previous position as head of dishwashers, Schipke successfully managed one of the few MABG projects in a decade that went beyond bells and whistles-factory and product redesign that cut costs, improved quality, and doubled market share. That's not to say that Shipke favors big investments, however. Conservative by nature, it came through sales, knew the importance of profit, and, like most in Louisville, went beyond the early 1970s head about producing everything in America. But one of Shipke's priorities was to get rid of Louisville's disease. When separation becomes a disadvantage, people tend to turn to each other - Schipke has worked hard to change that, getting competing managers to work together and emphasizing cooperation with unions. Gradually, the IABG became more and more cohesive. And now Shipke has been handed this offer. The compressor team had numbers proving that the new plant would be more than ten times more productive than any other. Because the plant was so automated, labor costs were not as big a factor as Shipke expected. He said it was time to accept the offer from Jack

Welch, THE chairman of GE. Blunt later recalled a trip by plane. The stakes were that they would not get approval. A few years earlier, the leadership had been almost haughty towards the Japanese; they could never touch the quality or technology of GE. That's changed. The attitude now is that the Japanese have become a production of geniuses. Why try to beat them when you can borrow from them? Or buy? It was Blunt's first time in the Fairfield boardroom. The room was almost empty when he filed into the Louisville team. Then came half a dozen executives from headquarters, including Jack Welch. Louisville people did their job. Jack poked us three or four times, Blunt recalls. The Chairman then asked his colleagues their opinion. Some said they doubted it could be done. Welch looked at Blunt. Why should I believe you people can build a factory to do this? He asked. You've never done anything like this before. No one ever asked us, Blunt said. And I think we can do that. Welch nodded and addressed Ed Hood, GE's vice chairman and one of his most trusted technical advisers. Blunt watched as he pulled out Hood's comfort level. Blunt was counting on three things. Welch, in his opinion, believed in Shipke's new management team. He saw figures showing that the plant could do it If the technology works. Finally, finally, wanted to keep basic appliances as a core business for GE and was concerned enough about Louisville's slide to know that only a major investment could turn things around. Welch returned to Shipka, Truscott and Blunt. OK, he said. Forward. Keith Moore, recently transferred from the GE lighting business in Cleveland, was in charge of the launch. This initially meant upgrading an old Columbia, Tennessee air-conditioned compressor plant with new processes developed by Blunt's engineers. Moore's men soon discovered that it was easier to develop a new process than to make it work. Supplier warnings were correct. At first, GE couldn't get the equipment to do what Blunt's engineers wanted. It took endless hours of debugging and hundreds of changes on each machine. The necessary tolerances were so extreme that even the smallest slippages could throw away the whole process. Ultimately, GE had to develop new measurement and sensing systems to force the machines to instantly adjust how they worked. Equipment deliveries were 2 months late at the start and up to 14 months later at the end. Management found it difficult to run this process from Louisville, 200 miles away, so GE rented 22 apartments in Columbia to train engineers. The company even launched a daily air shuttle between the two cities so that laboratory results could be delivered from Louisville and test observations could be delivered back from Colombia. By October 1985, GE had finally begun the first phase. The old factory started producing a new compressor - first 5 a day, then 10, then 100. By the 5th month, it was down to the volume of production, with the quality of the holding just fine. But if GE succeeds in the second phase by forcing the new fully automated plant to operate, it will have to face another challenge, no less important than improving the equipment: improving its workforce. A country with high wages cannot compete with the best technology; other weapons should be better trained labor. Can MABG create that in a place like Columbia, Tennessee, where the biggest annual Mule Day holiday is? GE knew it would have to try. Hiring high-wage technicians from all over the country was too expensive. At $17 an hour-benefits included-the new plant can still beat the competition, but not at $25 or $30 an hour. So GE planned a new plant with assembly people already there, in its Columbia air conditioning complex. Most of them were unqualified. Few had more than higher education. GE has decided to make another big investment: it will build one of the most complex blue-collar training centers ever established at a factory in the United States. The cost would be more than $2 million, which would have been difficult if GE had not received help from a welcoming partner. Tennessee provided the company with a training grant. But MABG still couldn't afford to pay workers for hundreds of hundreds additional hours will be required to train them. Therefore, GE asked workers to donate 120 to 400 hours in classrooms, labs and computer stations without pay and without a guarantee of promotion, which would depend on how they performed. All GE has to offer is new skills. Paul Varner, who was appointed to help run the training center, thought the whole idea was a bad mistake. He worked on an assembly line in Colombia and knew that most people there were conservative souls, fearing something new. They already have safe jobs; what's the point of sacrificing up to a year of nights and weekends without a salary? He guessed that almost no one would volunteer. It took me two weeks to realize that I was completely wrong, Varner said today. I ate a crow. Workers lined up for training. Partly it was because of the prestige GE gave it. Those who went through got diplomas and graduation dinners. But there was another draw, the same one that prompted Varner to apply for a job at the training center. He saw factories across America closing, and knew it was a matter of time before the distant forces put him out of work too. Colombia's old equipment was outdated. They couldn't hope to beat rivals in the 1980s with a factory in the 1960s. So when GE announced its new plant, Varner wanted to be a part of it. He didn't mind unpaid nights and weekends at the training center. For him, joining the future was a sufficient incentive. And, as it turned out, it was enough for hundreds of others. Clayton Russell was one of the first. Russell was hired in 1974 for unskilled assembly work. That's all we had back then, he says. His job is to put four screws in the rear body of the air conditioner-712 once a day. Gloria Anthony started that year, also on the line. Monotonous work, she says. Over and over and over again. Then the construction of a new plant began. To be a part of this, they would have to put in hundreds of hours of training, all on their own time. Never mind. They attended training in the morning, at night, on weekends. Whenever we had a chance, Russell says. Dan Edlin, another lineman, landed 400 hours. Like others, he was motivated more than the chance of a bigger salary. I wanted to be able to be on something completely new, he says. That's where the business goes -automation. Was there any discontent that automation would cost jobs? Cars don't hire people, he says. Machines create new jobs. Anyone who wants to get out of his duff and train can have one. In the first year of the center, GE Columbia employees spent more than 50,000 hours learning new skills. Paul Varner has learned a lesson: Give american workers a chance, and they will sacrifice for it. From Welch down, they said: You can do it, Varner. We wanted to their faith in us. Soon Keith Moore faces the following task: moving production from a converted air conditioning plant to a new factory. He knew that making a newly completed plant perfect would mean thousands of adjustments. He also knew that his sex workers would be best able to detect many of these adjustments. Thus, from the very beginning, he held meetings with workers and engineers, sitting shoulder to shoulder to discuss improving quality and efficiency. Moore was just as likely to reorganize part of the plant at the suggestion of an assembly worker as an engineer. And soon he received an unexpected reckoning from the extension of responsibility through the ranks. In the past, even if the little thing went wrong, linemen had to call the supervisor to solve it. Now they've fixed it themselves. Part of it, Moore says, is learning: they know what to do. But they also feel they own their part of the factory, making it run at them rather than their bosses. Moore also received workers involved in writing training manuals for equipment. He figured that if they were to teach techniques, they would get to know them better themselves. Finally, he forbade finger pointing. Moore has seen workers blame each other before when something went wrong. Therefore, he announced that any failure would be considered by the whole team. Thus, Moore hoped that if one worker had problems, everyone else would come together. They did it. Looking back, Moore realizes how important it was to maintain camaraderie. Frustration could easily spiral out of control. Late delivery is a backup schedule. Processes that worked in the lab often failed on the factory floor. There were late nights and sometimes 7am. Sunday morning meetings. But they did it; The plant opened on schedule in March 1986. Both production and quality went smoothly, although inevitably there were mistakes. Having a older plant to occasionally fall back on was a blessing. GE admits that it had to pour in more investment than expected, which happens when you push the edges of technology. But the plant works, exceeding the quality and cost targets. Ask Moore to point out one thing that did this, and he won't mention the equipment; he says it is the freedom he gave his employees. We have provided people with the tools to work in the factory. The celebration was short-lived. In January 1988, 22 months after the first compressor rolled out of the new plant, there was a problem. Some of the larger compressors - those in GE's large refrigerators - have started working. It was only a small percentage of the total production of the plant, but for a consumer product like this, reliability is important and therefore customer satisfaction. immediately formed a team of design engineers to find out what was going wrong. The team worked for weeks, often all night. Night. the fact that only a small fraction of the compressors actually failed to make the job particularly difficult. But based on these few, engineers went into a massive testing program and found that others may fail too. The team soon discovered what had happened: the lubricant problem caused one of the smaller parts of the compressor to wear out faster than expected. The problem mostly affects the compressors that were supposed to work the most, but some others didn't too. Eventually Shipke learns that GE was not alone. Japanese companies using rotors faced similar problems. But it was no consolation. Now that the cause has been isolated, finding a fix has become Louisville's obsession. Truscott and some corporate engineers led a new team that had been working on the problem for months. Finally, the team came up with the best design and showed it to Shipke. He was sure it would work and told the team to go forward. Meanwhile, he approved a plan to immediately replace any compressor that broke down - service people will be sent to customers' homes at the expense of GE. Nevertheless, Shipke faced a serious dilemma. Although projections have shown that only a small percentage of compressors will fail, the reorganization of the lubricant device will take months. He didn't want to risk GE's reputation by carrying refrigerators that might have problems. To be as safe as possible, he made a painful choice. In the spring of 1988, he decided that MABG would start a source of reciprocal compressors from abroad, while the engineering team put the fix in place. This would mean layoffs at an old factory in the Columbia complex. And that would mean a high load, since GE had to pay the top dollar for sources and borrow more contracts than necessary. Shipke knew it would probably cost GE a lot less to stay with its rotors and just replace the ones that eventually broke down. But every failure, he feared, would damage the company's reputation. It was more important than today's money. He took some solace in knowing that he could allow the new factory to continue making rotors for many GE refrigerators. He was also relieved that the group would return to full production within a few years. But it was and remains a painful time. The problem of the compressor has caused sharp criticism from both competitors and the press. Some at GE are confused because they had to source. Others are annoyed by how much money the problem costs: MABG's profits in 1988 declined due to a problem with the compressor, which ate years of savings from the rotary program. Still others are angry because this could potentially have been avoided. Early laboratory tests have shown that compressors will last 20 years, but it is clear that the most correct is performance in this area. In hindsight, many MABG executives see a lesson. With a completely new technology, it might be wiser to introduce it develop bugs over several years than convert all production to it immediately. The irony is that more than 90% of GE's investment in compressor and risk-associated at the plant is by far the most complex technological problem. And the factory works perfectly. A relatively simple part of product design in itself has caused a crisis. As GE knows, casual product reviews are part of the price of gambling on new technologies. This happened with fuel-injected car engines, electric razors and microwave ovens when they were first introduced, and now it's with the rotary compressors of the refrigerator. The cost of GE is high. But the payoff is still worth it: here in America, GE continues to make compressors that are 20% cheaper than any dollar-per-hour competition made. Gloria Anthony is now an experienced dispatcher who can control machines using a computer, regulating them whenever the terminal tells her that there is a small problem. I never thought I'd go so high,' she says. When I started, I was just sweeping the floor. Both pride themselves on being part of a factory that makes twice as many compressors as the old one, with less than a quarter of people. Performance, they say, is the only way America can compete. We got the production, Russell says. It's a sense of pride. Edward Fite, director of the training center, guides visitors around Colombia's automated factory with the pride of someone showing off their new home. Overhead, compressor pieces roll down long, winding gutters into machines that stamp, cut and refine; computers direct parts from one machine to another, warning that they are on the way. Machines work and work without ever stopping. Grinders, welders, testers and robots do their drilling, milling, tapping and evaluation. There may not be another mass-produced plant in the world that produces goods accurately. Most people stand in front of computer terminals: they are symbols of a new American blue-collar worker equipped with tools to make peace. At 36, Fite himself came from stuffing wires to train workers how to run a high-tech factory. He sees in people like himself the ultimate mission of a factory like this one - it gives ordinary people a standard of living that goes beyond what they ever hoped for. Tom Blunt will always be a figure from earlier America. I like the sandy stuff, he says. His father was a toolkit, and he proudly traces his origins through 11 generations of factory mechanics. But he knows that the United States can lead the world in factories only by creating a new species. At his desk in Louisville, he leans over a computer terminal and punches a few keys. moving chart chart Screen. He explains that he oversees a factory in Colombia. Sitting in Louisville, 200 miles away, he can look at the computer in the guts of any machine he wants, judging how it works, how many parts were done correctly, how many should have been set aside for rework. Let me show you something interesting, says Blunt. He punches a few more keys, and then leans back, clasping his hands behind his head. From 7 a.m., he says, we've made 3,413 pumps. It presses the update button. Sorry, he says, 3415. It presses the update button again. So far, he says, we've only had five defective parts today. He presses another button and nods; the computer shows him a chart of the day's tolerances for one of the charred parts. The problem was with one of the grinders that went down, he says. This has now been fixed. Is there another plant in the world that would automate the information system? There is none, says Blunt. Building 4 still stands a few hundred yards from Tom Blunt's office. Only now it's half empty. Even if Colombia hadn't been built, it would've been dead by now. The choice was simple: it would either be replaced by a foreign plant or an American factory; foreign wages or American wages. Despite the setbacks, GE is proud to have decided to go from this side of the ocean. A version of this article appeared in the March-April issue of Harvard Business Review for March-April 1989. Reviews.