viprotron

The most common and costly problem areas in glass production

... and how to identify and neutralize them effectively.

E-BOOK EDITION 01

Content

Editorial

Whether for the highest quality facades and interior glazing or for simple plastic windows and shelves, the same applies to all producers: Productivity, costs and quality accepted by the customer must go hand in hand. In this context, even many factors that may seem insignificant determine whether productivity, cost and quality targets are actually achieved.

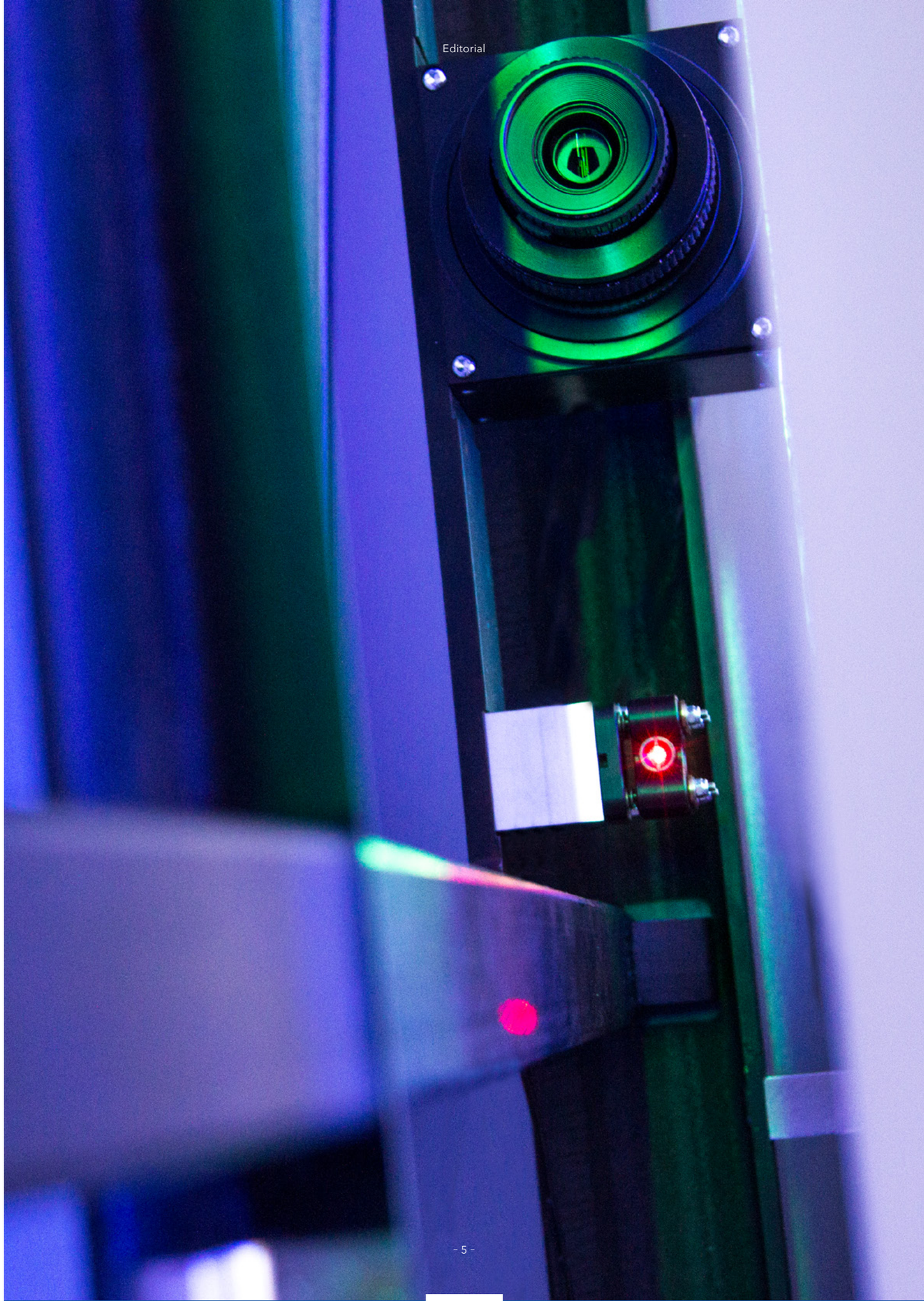
Let's start with the cost of the glass itself. A short time ago, it was "only" a simple glass shortage that virtually doubled the purchase price of certain types of glass within a year. Today, the energy shortage, especially in gas, threatens an even higher rate of price increases, which must and will require a rethink on the part of many glass processors. Whereas in the past the motto was "productivity before quality", today process stability and quality must take precedence in order to simply achieve cost targets. Delivering and, if necessary, even replacing several times is no longer an option given the increased cost prices for glass and other materials. There is now a valid risk of significantly increased scrap costs.

Every walk through production can open up potential for error prevention if you look closely, whether by identifying errors in the workflow or in the product itself. In the manufacturing process, therefore, all production stages must be analyzed. Often, the right equipment and materials are available, yet detail problems appear that are initially ignored but later turn into costly problems and, in particular, have a negative impact on product quality. In addition to errors in the product, workflows that are not accepted by the employees are also often major sources of errors. Workers then work past predefined processes due to ignorance or for supposed reasons of simplification.

Many are looking for the big hit, but the solution usually lies in small steps. In this E-Book, we explain how a first approach can be successful. As a specialist in glass quality, we will show you at which typical points in the respective production stages errors occur. You are probably subliminally familiar with one or the other of these sources of error. Becoming aware of and consistently eliminating the sources of defects in your production will help you to save glass and other material, energy and working time, while ultimately achieving a higher level of quality, greater process reliability and significantly higher productivity.

Let's take a "virtual" walk through your glass production and look together at typical risk potentials in the individual production stages. Benefit from our practical tips. Because with our experience, such sources of error can be eliminated and efficient production processes can be achieved.

At the end of our E-Book, we have a special and limited offer for you! But for now, enjoy reading and we look forward to exchanging ideas with you!



The Basic Product Glass

It is nothing new that when there is a shortage of marketable glass, a "B-quality" is also increasingly supplied, i.e. glass quality which, if at all, only just meets the standards. The poorer the glass quality becomes, the more you are required to use quality control in order not to feed the poorer raw glass quality into the value chain and thus reduce productivity. Ultimately, in the worst case scenario, poor quality glass would then reach the customer and, as is well known, cause further problems, such as complaints, returns and follow-up costs, etc.

While sites of corporate groups have been particularly affected by this problem in the past, medium-sized non corporate companies are also increasingly seeing themselves as affected and being responsible for tackling this issue. It is not a new insight that a B-quality is then often increasingly sold to affiliated companies of the float manufacturers in order not to have to bunker the produced inferior glass quality, but in principle more or less all are affected by this and therefore cannot avoid a sensible quality control.

What to do? You can't assign employees to look for raw glass defects all day long. Manual processes would be enormously time-consuming and cannot lead to 100% control.

Practice Tip 01 – Defect Optimization

Normal downstream cutting plans are not based on glass quality, but only on theoretical yield. This is independent of the type of optimization; no matter if single sheet – or online optimization, which of course already brings advantages. But even that does not solve the problem that quality aspects are not taken into account during optimization. Glass defects will still find their way into your production and will probably only be found later in the production process, when the pane has already experienced greater added value.

A professional scanner-based automated incoming inspection prior to cutting can remedy this situation. It ensures that core defects – such as bubbles, inclusions or already applied defect marks – which, due to their size, are certain to lead to internal rejects later on, are detected and rejected or, if sent to the customer, result in a complaint.

Despite the separation powder application, the glass is analyzed. In a manual workflow, the defects are displayed to the operator at the breakout table, who then decides what to do with the defective pane. If it cannot be saved by reworking, it can be scrapped here without adding any further value. Re-cutting can also be initiated immediately. In an automatic workflow, only the defect coordinates are sent to a re-optimizer (e.g.: A+W Defect Optimizer).

"In the past, we have had to take the furnace out of production on average once a week for unscheduled cleaning to remove broken glass in the heating area without leaving any residue. Anyone who operates a tempering furnace knows what effort this means and the loss of production. By using the ECO Scanner, we were able to limit these downtimes to once every two months. The investment paid for itself quickly and made our lives a lot easier."

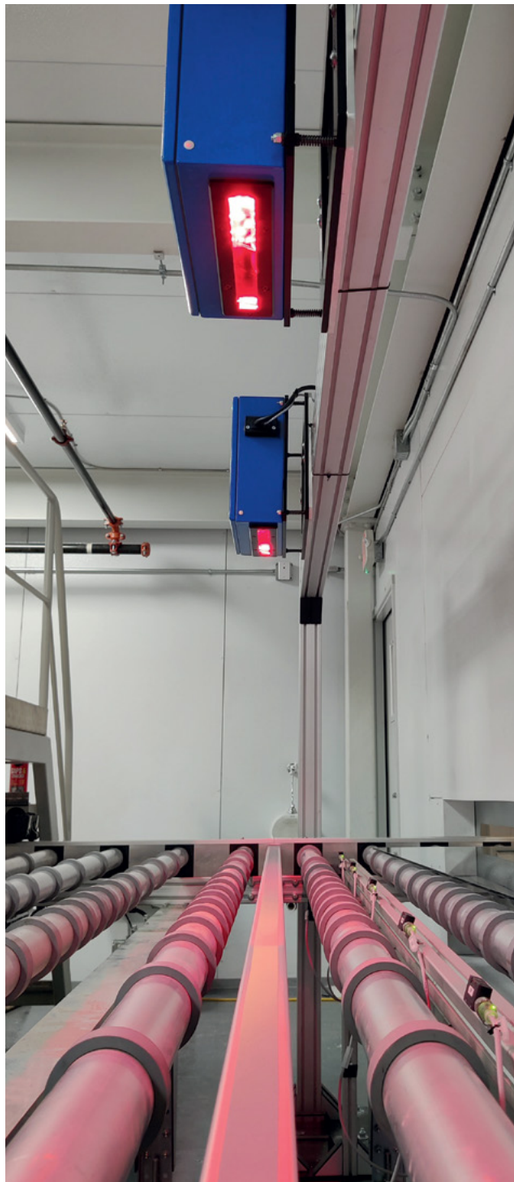
– Production Manager at Carlton Glass (Singapore)

This re-optimization calculates a new cutting plan that takes into account the breakout sequences and, if possible, places an area of waste or small glasses on the defects.

Re-optimization can of course also be based on a data set supplied with the base glass. A barcode individualizes the base glass and defect coordinates are directly provided for re-optimization.

Practice Tip 02 – Downtimes

Considering the cutting area as an internal supplier, "incoming inspection" can even solve problems in downstream processes that, at first thought, one would not directly associate with incoming inspection. For example, Carlton Glass / Singapore has used a quality scanner to minimize downtime for its tempering furnaces. Panes ready for the tempering process are now inspected for inclusions and bubbles prior to furnace loading. Panes showing these defect patterns are rejected and manually recycled if necessary, but no longer cause breakage in the furnaces' heating chambers.



“The project hung in the planning for a long time. But today we are happy to have done it. Bad glasses are automatically rejected and if possible, reworked. If not, they go directly to the bunker and the re-cut is reported.”

– Scheuten (Venlo, NL)

Cutting

In addition to the raw glass defects just described, scratches caused in the cutting process itself are a major problem. If trims are not cleanly removed from the cutting table during zero cuts, small fragments travel on the glass all the way to the breakout table and are removed from the glass surface manually and normally with little care, if at all. Or small glass splinters on the breakout table that are not vacuumed off in time lead to hairline scratches that are almost certainly overlooked during production and only appear later in the window or in the facade with high follow-up costs. Of course, vacuum cleaners certainly are available at every breakout table, but typically they are not used regularly.

Practice Tip 03 – Cleanliness

On a sunny day, stand at the breakout table in a way that the splinters lying on the table reflect the oblique sunlight. You will be amazed at what can be seen on the table. Even if it sounds banal: what is the use here? Vacuuming the table at least every hour! Here, the hopefully existing procedural instructions should be adapted and the shift supervisor must keep an eye on that the procedures are followed. If the operating personnel are international, multilingual process descriptions and repeated instruction of the personnel can also improve the process.

„We have improved our cutting process with Viprotron. The JUMBO CONTROLLER helped us to reject bad glass directly and since we make sure to vacuum regularly at the breakout table, we have significantly fewer complaints due to scratches. In the meantime, regular vacuuming has become second nature to our operators.“

– Energy Glas (Wolfhagen, DE)

Another issue is poorly broken edges. Depending on their characteristics, noses or undercuts can lead to major problems, especially during subsequent processing into insulating or laminated glass. If the panes are automatically broken, the edge problems are only detected immediately before further processing on the insulating glass line or in the laminated glass clean room. Then the good panes and other prepared components have to be removed and stored temporarily until all components of the insulating or laminated glass have been made available. What is to be done in case of a high degree of automation?

Practice Tip 04 – Edge Control

A Quality Checker can control both the squareness of the pane by diagonal inspection directly behind the Z-break and the edge for noses or undercuts. This can ensure that only sheets with a sufficiently well broken edge reach the next process stage or sorting.

Glass Processing / Fabricating

EDGE PROCESSING AND SURFACE PROCESSING

What do you often see? With the exception of a double edger with a drilling station or a robot linkage of vertical grinding machines, there is usually a low level of automation. As a result, an operator occasionally notices glass defects, should they have cheated their way through to this point. However, the single processes (grinding, drilling, cutouts) require checking for completeness and correctness of the dimensions.

This already starts with the squareness of the panes. Especially with low-toleranced serial glasses, it is particularly annoying if the rectangle rather resembles a slight parallelogram.

Practice Tip 05 – Squareness

If the glasses have a dimension so that they can be turned over without any problems, you can turn them against each other so that the first surface (Pos.1) of the first glass touches the first surface (Pos.1) of the second glass. If the edges of the glasses diverge and form an acute angle, the squareness is no longer given.

Input errors at the machine, handling errors (scratches or broken corners) are further issues in this area. The higher the level of automation, the less “random” testing of glass quality takes place.

What we observe is that hardly any checks are made after optical defects, but – if at all – cutouts or hole positions are checked with the measuring tape against the production sketch. How can things be better?

Practice Tip 06 – Contour Checking and Optical Errors

Checking of contour, squareness, hole position, etc., as well as an additional optical inspection can be done by a scanner. On a calibrated transport, the inspection device checks all dimensional and optical requirements placed on the pane. First, a dxf from the PPS is sent to the scanner, then the glass runs through the scanner and then is compared with the dxf. The tolerance dimension can be specified with different values, for example to distinguish between A and B quality.

Tempering

In order to fully and reasonably utilize the capacity of the furnace, only qualitatively pretested sheets should be tempered. Loading the furnace with possible defective sheets – as already shown in the example of Carlton Glass – is problematic from a process point of view.

Practice Tip 07 – Furnace Bed Optimization

It is highly recommended to use furnace bed optimization from your software supplier to make the best possible use of the furnace. The charging sequence has already been taken into account on the delivered racks. The feed display also indicates sensible distances between the panes, which must of course be observed to avoid pane collisions in the oscillation process.

For loading and unloading larger panes, the furnace manufacturers have attached rollers to the sides of the belts. Using these, panes can be loaded or unloaded with less effort. As a rule, the preloading areas are not "clinically" clean, so dust can often be found. This settles on the rollers and transfers to the glass.

Practice Tip 08 – Use of Manipulators

To prevent the transfer of dirt from the rollers to the glass and to place the glass more precisely on the infeed conveyor, as well as to relieve the physical strain on your operators, we recommend the use of manipulation devices on the furnace infeed and outfeed conveyor. From a quality point of view, please provide the suction cups of all your manipulation devices with overshoes that avoid suction cup marks on the glass and on coatings. This applies not only to suction cups on the furnace, of course, but to all in your production in general.

In the tempering furnace, the glass is subjected to the greatest physical stresses. For this reason, several checks are already carried out here due to the process, such as rollerwave measurement in the laboratory, a Haze test with transmitted light in a darkroom or an anisotropy test on a wall with polarized light. This results not only in exorbitant manual inspection effort, but also in huge documentation effort. Therefore:

Practice Tip 09 – Use of an Anisotropy, Haze and Waviness Scanner

All inspection and documentation tasks are taken off your hands by such an inspection device. And this with a 100% control of the processed glasses. The control values can be used directly by the process manager to optimize the furnace parameters. In this way, the negative influences of the tempering process on the glass quality can be avoided as far as possible and productivity can be increased.

Behind the furnace, labels are assigned to the individual sheets. Production labels can be reused if necessary and depending on their condition. Shipping labels have to be reprinted. If an oven bed optimization is available, assignment is easier. If not, a measuring tape is normally used and the glasses are measured on the outfeed conveyor for label assignment. However, this can again lead to scratches

.*Practice Tip 10 – Labelling*

It has proven useful to reprint all labels behind the oven. Often, the production labels are no longer fully legible or no longer stick properly and thus have to be partially replaced anyway. In combination with the oven bed optimization, the assignment of the newly printed labels is much easier.

Laminating

The “manual” visual inspection of a glass in a clean room is difficult. The glass is lying on a horizontal conveyor belt. Operators can hardly detect defects because they are looking through the glass and their eyes are distracted by many details in the background. This is why scanners are being used more and more frequently in laminated glass production lines.

A scanner-supported quality inspection of the individual panes before the clean room is currently mostly carried out behind the washing machine and in front of the clean room. After washing, the pane passes through the scanner into the clean room. There, the results of the scanner are displayed and cleaning or rework begins. To retrofit an existing cleanroom, this is certainly the best place for such an inspection. But what happens if the pane has to be scrapped? Offloading is usually not an option; the pane must exit the clean room through the pre-lami conveyor.

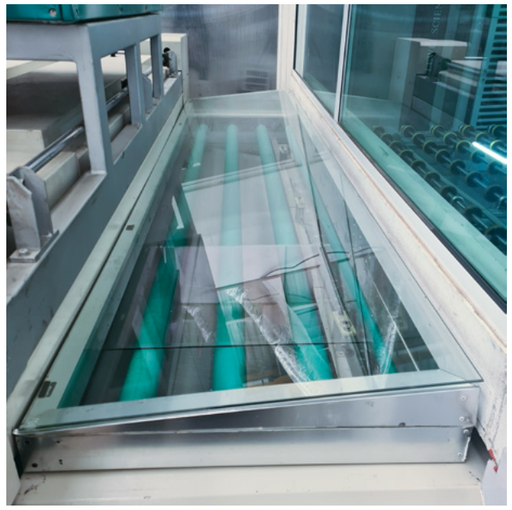
Practice Tip 11 – Clean Room Planning

If you are planning to build a new clean room, provide for the possibility of outfeeding a defective pane. Alternatively, an inspection of the individual panes can be carried out well before they enter the clean room – although this requires space. The glass passes through the washer and scanner and then into an inspection station, which is also a tilting table. At this point, the glass can be reasonably inspected vertically before it continues horizontally into the clean room. Should the glass need to be rejected, this takes place well before the clean room.

There is always a certain distance between the washing machine and the clean room. On this distance, dust particles could fall onto the glass passing through, which would then later end up in the laminate.

Practice Tip 12 – Dust Cover

Here, a simple cover over the conveyor belt between the washing machine and the clean room can be a simple and pragmatic solution.



The finished laminated glass coming out of the autoclave should also be checked for suction marks, fingerprints or other imperfections. Since normal hall lighting is not helpful for such a check, a manual check can be carried out in a dark room inspection cabinet.

Practice Tip 13 – Dark Room

Install a simple closed dark room (rack with dark back wall) to cover the maximum glass size. Here, the glass can be manually checked for low-contrast defects in the »dark field« with indirect backlights. However, this simple solution has the disadvantage that the glass must be moved in on a rack. This, in turn, can cover areas of the backlights, which can result in defects not being detected. Optimally, a scanner can be used here to reliably detect all defects.

Insulating Glass

The insulating glass lines are also bottlenecks in the production process. In order to avoid major interruptions at the lines, the panes should be pretested so that only flawless glass reaches the lines.

As a rule, however, this is not the case, because in order to use as few scanners as possible in the production process, the bottlenecks in particular are often selected as inspection positions. If the single pane is inspected after the washer in the inspection station, there is at least still the possibility of saving defective glass by cleaning or reworking.

Depending on the requirements of the market, either entry-level scanner solutions that reliably cover standards make sense. If significantly higher quality requirements have to be met, such as for high-quality façades solutions with safety glass requirements etc., you should make sure to use multi-channel scanner solutions in order to detect all relevant defect patterns.

Practice Tip 14 – Control Criteria

If the scanner used has multiple channels, the inspection area should be equipped in such a way that those working there can also find the defects pointed out by the scanner. This includes an inspection station with a matt black background, professional background illumination (e.g.: o.m.p.) and an LED hand lamp. With this equipment, the results of scanners with up to three channels can be easily found. If the operators do not have this possibility, they cannot always verify the displayed errors, will doubt the results of the scanner and may ignore it later.

Productivity Losses

On the previous pages, we have only been able to show you a few examples of problem areas in the individual production stages. They all have one thing in common: in addition to costs, they also lead to productivity losses. This applies not only to defects in the raw glass, but in particular to self-inflicted defects such as badly broken edges, scratches, incorrect dimensions and much more.

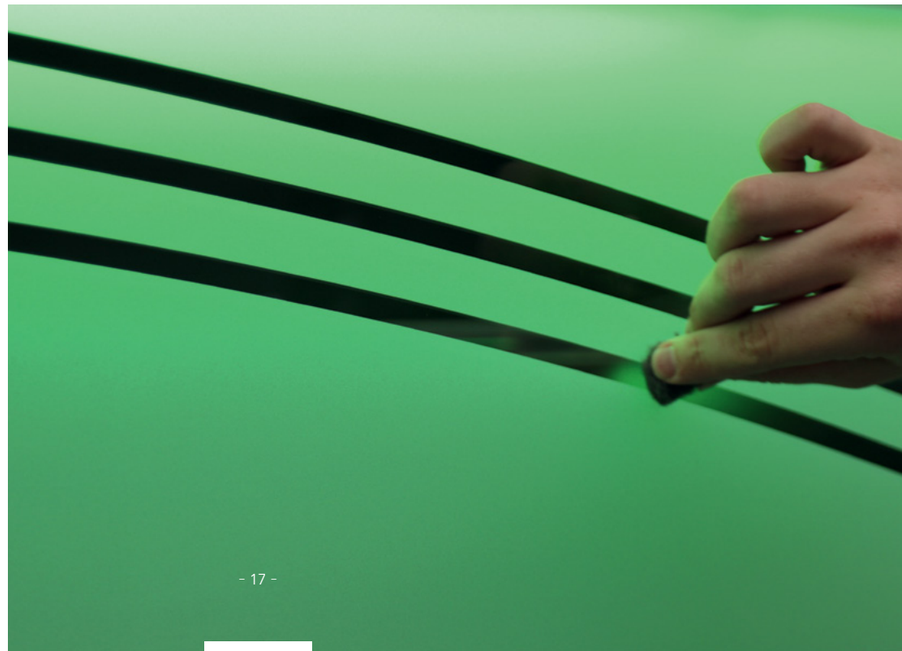
High costs for rework, additional workload for the individual production stages due to multiple production have to be coped with if the individual process steps are not focused on a quality-oriented way.

What would it mean for you if you had less:
… Rework in your production, …
… double production of finished products, …
… disruptions in your production processes?

— Desired State

You have specific productivity, cost and quality targets? You do not want stress? What would be your personal desired state and where do you see the greatest challenges and potentials in your production process?

If you have found yourself in one or more points of our practical tips, then you have a considerable productivity potential and risks that can be activated or neutralized quickly and effectively with the right measures.



What The "Potential and Risk Check Glass Quality" from Viprotron Offers You.

We offer you our "Potential and Risk Check Glass Quality". In a personal or virtual visit, we go through the relevant processes in your production together with you:

- **Cutting**
- **Processing / Fabricating**
- **Tempering**
- **Laminating**
- **Insulating glass**
- **Special glass production**

As a result, you receive a clear and objective evaluation of your production processes from a quality point of view as well as a potential and risk assessment with tips and hints that you can implement immediately.

The implementation takes place in your production or virtually on line. Please plan 60 - 90 minutes for the Potential Check. We offer this service without charge. The time frames are limited. If you are interested, we therefore recommend a prompt request at:

potenzialcheck@viprotron.de

You now have two options:

1 Do nothing for the time being, wait and reject this special offer for a potential and risk check of your production. But then please do not be surprised if nothing changes with your existing production issues or if existing potentials are not activated.

2 You have recognized that the Viprotron "Potential and Risk Check" is a special opportunity and now ask for a free time slot. You have also recognized that performing the "Viprotron Potential and Risk Check" is a special opportunity with minimal own time effort to increase your productivity and quality level quickly and effectively.

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