

Equipment Cleaning, Purging



Dry ice cleaning extends the running time of the mold, prevents damage

The situation

Performance Plastics specializes in high performance injection molding. The company produces small, complex, high quality parts with material attributes that solve their customers' toughest problems.



For 30 years, they've focused on the application of these highly engineered plastics for the performance advantages that they provide when producing intricate part geometries with extremely tight tolerances.

They excel at helping companies in the medical device, energy, aerospace/defense, industrial, electronics and food and beverage industries solve current product problems or to create competitive next generation advantages.

"From designs through production, we do what others have dreamed of, failed at or said can't be done," said Tom Mendel, president and CEO. "We are defined not by the industry, but by the material we run, the sophisticated tooling we use and the tight tolerances we hold."

The company has aggressively lowered their per part cost with a proprietary, high volume direct gating hot runner injection molding process that significantly reduces waste and costs. They have molded PEEK since the material was first introduced in the early 1980's and they have deep experience as an approved processor of Torlon. They have also been involved in development work for liquid crystal polymer (LCP) resins. The company is one of the few able to mold fluorinated ethylene propylene (FEP) using eight-cavity, high volume molds with hot runner systems to produce critical fluoropolymer parts.

They do not mold commodity plastics or bid in auctions. They concentrate on the high-end materials that give customers the properties they need for very specific applications. In other words, the really tough stuff. And they are growing. Almost 30 percent of the components produced are shipped to international customers providing "Best in Class" value. "We are pushing the envelope here – running 150 miles per hour in a 20 mph zone," said Mendel. "We do lots of R&D, lots of engineering and lots of hard stuff."

The problem

As any mold manufacturer knows, keeping the mold clean is a must in the mold making process. But there are two problems. First, the mold is heated (in Performance's case) to an extreme of 450 degrees Fahrenheit, and the plastic coming into the mold can be up to 800 degrees Fahrenheit. As this happens, gas is generated as a natural byproduct and, as it liquefies, the volatiles generated will stick to the mold. With the extreme materials Performance uses in their molds, this gas sticks tough – Mendel said the contaminants can resemble tar.



Another issue occurs when the plastic is poured from one end of the part and flows around to the end-of-fill. At the end-of-fill the gas must be vented through a very accurate opening in the mold – one that lets the gas out, but does not allow the plastic to escape. This vent at the end-of-fill gets clogged from the buildup of the particulate gases that condense when the mold is cooled. If the tool doesn't vent properly, problems will occur. The gas can destroy the metal of the mold, or a part may not meet standards for quality.

This is why all molders aim to keep their vents clear in order to maintain a clean mold. As Mendel explains, good molders have a predictive

preventative maintenance program where they address the phenomenon of gas buildup in the mold.

Properly cleaning the mold is not only required, it is an acquired skill. No one wants to destroy the mold, because they can be a huge expense to replace – in Performance's case, some molds can cost as much as \$250,000.



When a mold is cleaned it usually requires a complete teardown – the assembly is stopped, the mold taken out, disassembled, and every nook and cranny is cleaned. Then it must be put back together. This is very time consuming, and because Performance Plastics is moving at high speeds they don't like to stop.

Performance's traditional method of cleaning molds can include any type of grit blasting, or using solvents and wire brushes. The secondary waste from solvents and other media can be a big problem environmentally, in addition to sometimes eating into the metal.

These types of cleaning methods can also be time consuming because the metal often needs to be soaked, or a wire brush must be later used

to mechanically remove the debris. In any of these cases, they run the risk of damaging the mold.

The solution

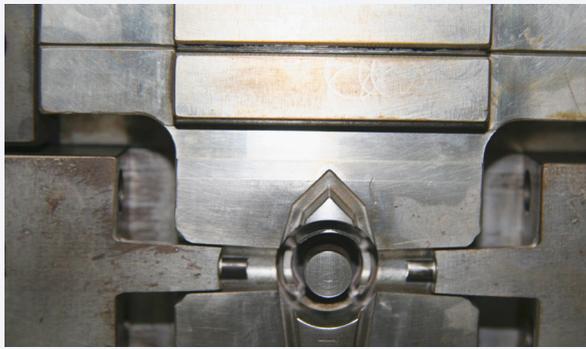
Mendel will be the first to tell you that mold makers are usually pretty suspicious, skeptical and critical when it comes to trying new things; they have seen many fads and gimmicks come and go. But because someone he trusted recommended trying Cold Jet to clean his equipment, and because Mendel is no stranger to taking risks—afterall, it's brought him success—he put down his guard and brought in the Cold Jet i3 MicroClean for testing.

Cold Jet's dry ice cleaning system uses non-abrasive media in the form of recycled CO2 media (pellets or block) that won't damage surfaces or equipment. The combination of dry ice blast cleaning's kinetic energy and thermal effects break the connection between the dirt and surface, lifting away contaminants. Unlike blasting with other media, dry ice cleaning does not leave any secondary waste, as the dry ice pellets or particles sublime – convert from solid to gas – upon impact. Dry ice cleaning is also safe and non-toxic, does not create downstream contamination, and reduces or eliminates employee exposure to dangerous chemical cleaning agents.

The results

After Mendel's team tried the Cold Jet MicroClean machine, everyone was on board with using the system. Since implementing the Cold Jet solution, Performance Plastics has been able to extend the running life of the mold by cleaning it in place in the press—including the vent and ejector pins—extending time between complete teardowns.

"Cleaning with Cold Jet will not roll parting lines, change or destroy the metal," said Mendel. "And best of all, it allows our running time to be extended. We use it every day, on every shift."



Mendel said the ability to clean the part in place with the Cold Jet solution really saves time. A complete teardown can vary with the part – sometimes it takes two days or 16 man hours to complete, sometimes it takes less time.

When running at extreme temperatures like Performance does, it's not just the teardown itself that is time-consuming – it takes four hours to heat up the machine and four hours to cool it down. Time is money in this business, and it's very expensive to shut down. The longer that a complete teardown can be delayed without damaging parts, the better.

"I would say that using the Cold Jet cleaning process extends the running time of our molds by 200-500 percent," said Mendel. "It saves us from cooling the mold down, removing it, disassembling it, reassembling

it, putting it back in and heating everything up. That is a lot of time and risk for damage. We are very sensitive to the extension of a production run and our startup costs. Once we get something running we don't want to stop."

When they do stop they use the Cold Jet solution, whether the mold is hot in the press or taken apart cold on the bench cold.

The second major benefit Performance has experienced is that Cold Jet allows a lot of flexibility when cleaning the mold. They can apply just the right pressure to prevent damage, which is something they cannot always do when using solvents and wire brushes. To illustrate how exact the molds at Performance can be, the shutoffs on certain high pressure materials have to be 0.0004"—because at 0.0005" it will flash, and at 0.0002-0.0003" it can't be vented and will destroy the metal. These molds are very delicate; 0.0005 equals one-sixth of the diameter of a human hair.

"That's pretty tight," said Mendel. "And when you go in with a wire brush and accidentally take a little bit of the metal off, the mold can be destroyed."

Finally, because a cleaner mold equals a better part, and the molds at Performance can now be cleaned quickly while running, the part is vented more effectively. Scrap rates go down, and quality goes up. And Performance Plastics now needs only one person to clean the mold, versus two, so critical personnel can be directed elsewhere.

"I would tell others to try this out," said Mendel. "Certainly everyone in this industry is skeptical and you need some skin in the game to take the risk, but the benefits are well worth it."

Säntis AG counts on ASCO

Based in the Swiss Rüthi, Säntis AG is the market leader in the field of coextruded multilayer films and injection-moulded packaging solutions in the food and non-food sectors. Säntis cleans its injection moulds with a dry ice blasting unit from ASCO CARBON DIOXIDE LTD. This allows the company to clean production tools gentle and efficient and therefore manufacture moulds more cost-effectively.



Cleaning of moulds with ASCO dry ice blasting technology

Injection moulding is one of the most widespread processes for the production of plastic parts. Säntis uses an injection moulding machine for liquefying the used material. The liquid is then injected in a mould under pressure. In order to free the injection moulding tools from adhering residues afterwards, the long-established company Säntis AG decided to clean the tool parts with dry ice.

Mr Gartler, constructor at Säntis AG, explains the advantages that ASCO dry ice blasting offers to the company: "Cleaning our injection moulds with ASCO dry ice blasting technology was well worth it for us. The ASCO cleaning method allows to clean the moulds very gently and yet efficiently. Since it is not necessary to remove the moulds, they can be cleaned directly in the machine which guarantees shorter downtimes and greater efficiency. This allows us to drastically reduce maintenance times – a crucial success factor as it increases production efficiency significantly."

ASCO offers dry ice blasting machines specially developed for the plastics industry. Only recently, the latest ASCO blasting machine ASCO Nanojet was introduced. Especially injection moulders appreciate this new product launch as it allows significant cost savings in mould and tool cleaning. Characteristic features of the ASCO dry ice blasting technology are very simple handling, low air consumption and a handy blasting gun with a short and specially developed plastic nozzle.

José Fernandez, Application Technician/Sales Dry Ice Application, explains the pioneering position of ASCO in the field of dry ice blasting: "The ASCO blasting process is not just a cleaning process, but an overall concept in which quality assurance and process reliability are top priorities. The diverse fields of application of dry ice blasting are still not exhausted. ASCO has therefore specialised in providing customised solutions for the industry and our customers."

ASACLEAN™ sets new standards in purging with UF2 compound

ASACLEAN is a leading company in the field of commercial compounds for purging in extrusion and injection molding of thermoplastics. Asaclean has recently premiered its new purging compound, UF2. This grade is optimal for extrusion of cast and blown film, as well as for injection molding. Just as any product of ASACLEAN portfolio, UF2 purging compound guarantees quicker switchovers, thus cutting down machine downtime, increasing its performance and enabling significant savings for producers.

To attain higher performance and efficiency, processors often run after a few goals at a time, e.g. rapid changes of material/color coupled with adequate contamination removal. UF2 compound delivers against these goals: it can easily be purged through a die with no need to remove the latter; it de-gels and decontaminates its passages, eliminating any non-carbonized residue; and, finally, it is highly compatible with PE polymers.

You can consider UF2 whenever a color/material change takes place, when a hot runner needs cleaning or sealing/shutdown. UF2 grade guarantees a faster cleanup with reduced product consumption compared to competitors. Particularly, for blown film manufacture, this purging compound helps converters “holding the bubble,” reducing downtimes and increasing performance. Moreover, UF2 ensures better parison adherence during blow molding.

An analysis of cost savings at a color change (black PE to natural one) during polyethylene extrusion has been recently carried out on a 4.5-inch die machine with a 50-pound barrel. When the customer’s traditional “next resin” method of purging was changed for UF2 by ASACLEAN, it resulted in less wasted resin and a much more rapid switchover. Machine downtime was significantly reduced, just as changeover costs (by not less than 65%), leading to overall savings exceeding \$23,000 per year.

UF2 by ASACLEAN boasts processing temperatures ranging from 170 to 320 °C (340...610 °F). A 0.0004” (0.01 mm) minimum opening is required for extrusion dies and hot runner gates. The grade is compatible with up to 200-mesh extrusion screen packs with a single mesh layer.

REP presents MLC500 cleaning laser

Introduction

For years, the use of laser technology has been growing in all industrial sectors. At the request of numerous actors in the rubber and polymer injection industry, REP has worked with laser-specialized partner Laselec and developed a laser technology machine called MLC500 dedicated to the cleaning of industrial parts and injection and compression molds.

What has been done in the past to clean molds?

The following orientations have been followed over the years and brought improvements:

Ultrasonic bath:

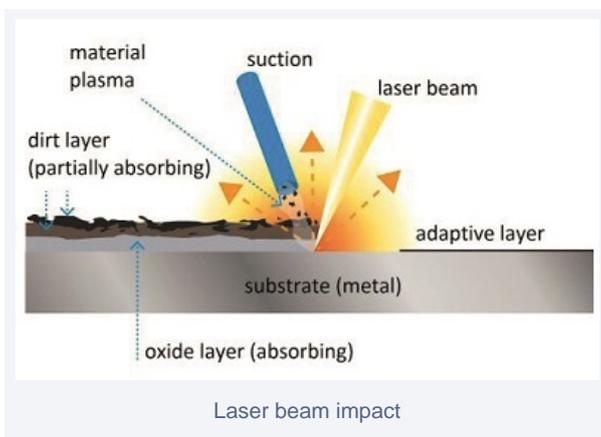
This is the most widely used method in several sectors to clean equipment. The process strips off undesired material in a non-aggressive manner. However, it is very costly and polluting. It requires the use of chemical additives (anti-grease agents, concentrated detergents, anti-corrosives, deoxidizers, etc.) This method presents risks to the health of the worker and for the environment. This also makes ultrasonic cleaning quite expensive. The use of ultrasonic cleaning also negatively impacts the user's production, because the process is time-consuming, requiring several steps: 1) creation of a high-frequency wave, 2) fluctuations between high pressure and low pressure, 3) appearance of miniscule bubbles during the low pressure periods, known as cavitation, and 4) implosion of these bubbles upon contact with submerged surfaces during high pressure periods. Additionally, some molds must be disassembled to allow them to be cleaned. Moreover, this process can only be used on cooled molds. The production will only restart after the mold has been cooled, cleaned, and reheated once more. At the end of cleaning, it is also necessary to plan time for the mold to dry.

Cleaning by projection:

Several different materials can be projected onto an injection mold in order to clean it: sandblasting, plastic balls, dry ice,... This process needs a low initial cost, but it requires costly consumables that are difficult to store. This technology is slow and, just as with ultrasonic cleaning, it only works with cooled molds. This equipment is operated manually, which results in high labor cost. The latest evolution of the projection technique is the use of dry ice which is not abrasive. Nevertheless, prolonged use of dry ice results in heavy humidity which can lead to the oxidation of molds. This process is also very noisy (over 105 decibels), and therefore requires the use of hearing protection equipment.

Portable laser cleaning:

Theoretically it's easy to be used on site as the equipment is portable. But it requires important individual protections and a protection of the zone to be cleaned. There is also an important risk for the operator and all other people close to the cleaning area. This equipment is operated manually which results in higher labor costs. The use of a portable laser doesn't allow for a regular scanning or the cleaning area (variable distance between laser and contact surface, longer paths in some areas, omission of some areas,...).



Laser cleaning is a non-destructive method, that is to say that only impacts the pollutant and does not degrade the substrate. Indeed, when the beam strikes the material to be cleaned, it creates a highly compressed plasma, which relaxes by creating a shock wave. This sudden expansion volume ejects the dirt. The fast pulse (10ns) prevents thermal effects from taking shape.

The laser beam is supplied by a movable rotary head and plane mirrors allowing for a maximum reflection of 1064 nm. The cleaning head moves along 2 axes: the X axis and the Y axis. The cleaning head can move along a 575mm X axis and

At the rotary head, the beam is redirected to the mold (Z axis).

One specificity resides in the movable head because it allows the laser beam to reach the mold with an incidence of approximately 15° around axis Z.

Different cleaning methods can be used, depending on the type of mold and dirt levels. The cleaning modes are:

- "Rotating cleaning": To clean with all orientations of the beam,
- "Head stuck cleaning": To clean with a fixed and predefined orientation,
- "Cleaning followed trajectory": The orientation of the head follows the path, ideal for cleaning the bottom of a

groove with precision,

- "Cleaning + 90 ° trajectory followed": The orientation of the head cleans accurately one side of a groove,
- "Cleaning path -90 ° followed": the orientation of the head cleans precisely the second side of a groove.



MLC 500 machine

- Safe class 1 laser in a closed enclosure, no chemical additive, no projection risk, possibility to work safely as close
- Pre-programming of the laser path via DXF file (CAD)
- Electric power: voltage/frequency depending on countries,
- Maximum mold dimensions: 690 X 505 X 150 mm (L x l x h) /
- Maximum cleaning usable area: 575 x 410 mm / 22,63" x

- Cooling unit in option

Laser cleaning can be used to clean rubber and gas fouling, to remove demolding/release agents fouling and also to remove the corrosion of the mold, without damaging the surface

Process parameters to achieve for a good and quick cleaning

are first the cleaning method, and then the laser power and the laser speed displacement.

O'Ring mold 150 cavities

- Mold 500x500 mm, 2 plates
- Steel: C45
- Type of fouling: EPDM rubber
- Cleaning method: rotating cleaning
- Laser speed: 12 mm/s
- Laser power: 13 W
- Cleaning time for the 2 plates: 30'

Metal/rubber part mold 8 cavities

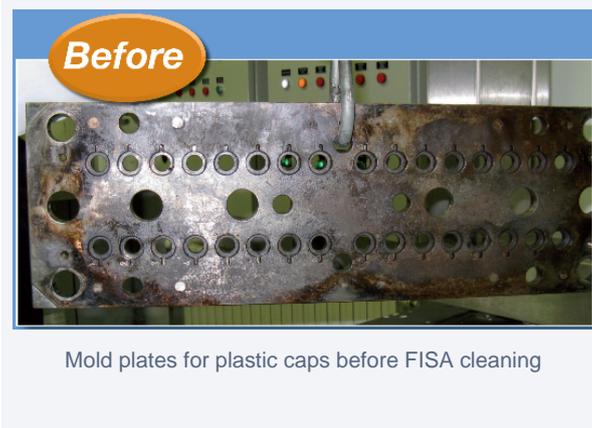
- Mold 510x630 mm
- Steel: stainless steel
- Type of fouling: rubber + release agent fouling
- Cleaning method: rotating cleaning
- Laser speed: 50 mm/s
- Laser power: 13 W
- Cleaning time for the whole cavity plate: 11'

Conclusion

Laser has the advantage of being a reliable, quick, safe, and ecofriendly solution with a quick return on investment for mold cleaning:

- Reduced operating cost:
 - no consumable
 - automatic cycle, reduced manpower
- Reduced production shutdown times:
 - no need to cool down and heat again the molds
 - possibility to program a faster cycle by cleaning only some dedicated and fouled areas and therefore to space out the complete cleaning of the mold
- Reduced installation costs:
 - No chemical materials to handle and secure
 - Silent, therefore no need to have protection against noise
 - Compact and mobile, low floor space requirement

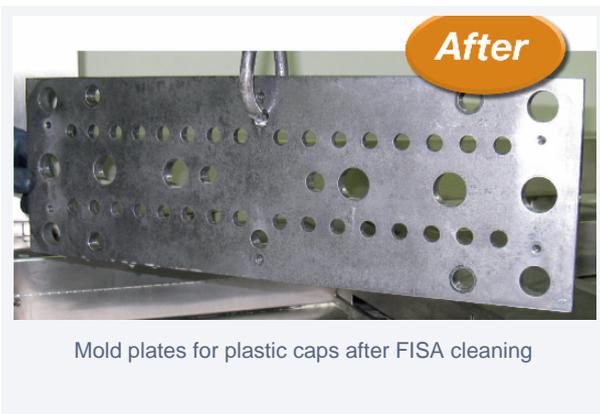
Three stations principle



On studying an ultrasound seller's catalogue, one can typically buy an ultrasound tank to clean molds and tools in. But cleaning a mold often implies removing rust, lime scale or other residue.

So a simple tank is not enough, because of chemicals that must be rinsed off. To explain it in a slightly basic way, the process can be compared with washing hands.

To wash their hands, people use soap and then they must rinse them to get rid of the soap. This is why FISA machines generally follow the 'three stations principle': washing, rinsing, maintenance/drying.



The first tank is for cleaning.

In the second tank, the cleaning product from the first tank is rinsed off and in the third tank the molds are maintained directly to avoid rust forming.

Then, there may be another station where hot air is blown to remove the moisture from every nook and cranny.

Thus there is a three-stage process which is very different to what ultrasound sellers offer in general, as they only provide one tank.

CleanPlus: a purging compound innovation from VELOX

VELOX has recently premiered a new series of purging compounds. According to the company's representatives, the new product makes it possible to reach savings of as much as fifty percent in money and time alike compared to purging compounds from competitors.

The new CleanPlus compound series includes three product types suitable for extrusion lines and injection molding machines alike. These can be used with resins such as PP, PO, PVC, TPE and TPU.

VELOX states that CleanPlus not only enables quicker material and color changes and flushing out accumulated deposits. The new compound is equally well suited for screw protection from corrosion during extrusion equipment shutdowns (sealing). According to the company, this keeps subsequent machine startups trouble-free and reduces waste considerably.

Enno Stapel, Product Manager at VELOX, explains, "With CleanPlus, we are pleased to have developed an absolutely efficient and cost-effective solution for some problems in plastic processing. Our 20-year long experience in manufacture of purging compounds has helped us to develop a product that saves the customer up to fifty percent of time and material — and thus, a lot of money."

The new product is supplied ready for use, with absolutely no preliminary drying or mixing required. The compound is not abrasive and can be safely handled by both machine and operator.

Besides that, according to VELOX, CleanPlus promotes faster cooling of extrusion lines, as well as easier screw pulling, as the compound does not adhere to metal surfaces.

"After customer testing, our new compound has been rated as excellent. We are very pleased about this, and it confirms our ambitions to take on and solve problems in production. We would like our customers to manufacture — it is better if our compounds do the cleaning," concludes Stapel.

Dyna-Purge introduces compound for polypropylene color changes

The Dyna-Purge Division of Shuman Plastics Inc. (Depew, NY) has introduced Dyna-Purge A for polypropylene (PP) color changes. The hybrid product combines key features of both mechanical and chemical purging systems, with advanced ingredients reaching all stagnation areas breaking down the color contamination. More efficient and thorough purging improves part quality while reducing injection machine downtime and scrap

According to Tim Cutler, Dyna-Purge Vice President, the company commissioned Penn State Erie, The Behrend College, of Erie, PA, to conduct an extensive independent study on Dyna-Purge A in March 2016 at the Burke Center – School of Engineering. The study compared commercial purging compounds and an in-house resin to Dyna-Purge A. In purging and post purge results, only hybrid Dyna-Purge A left the injection molding machine clean and free of contaminants, said the company.

“The independent study on Dyna-Purge A demonstrates that it is more effective than mechanical (abrasive) and chemical purging compounds and in-house resins for purging during PP color changes,” Cutler explained. “Dyna-Purge A saves time and money as it lowers purging costs and scrap rates.”

In testing, the purging process successfully transitioned from black to natural PP in only seven shots using Dyna-Purge A. The hybrid purging compound is engineered to exit the machine with the next production resin, leaving behind no residual purging compound. It is versatile for a variety of applications including hot runners, profiles, sheet and cast film, with no minimum clearances. Dyna-Purge A does not require soaking or temperature alterations, and will not produce noxious fumes and odors or leave behind residue, said the company’s information. Furthermore, the ingredients are safe and non-hazardous.

Chem-Trend expands in Eastern Europe

Chem-Trend, a global leader in the development, manufacturing and marketing of high-performance release agents, purging compounds and other ancillary molding products, announced the acquisition of the release agent business of its long-time distribution partner in Romania, Rubio Trading & Consulting SRL.



As part of a planned growth strategy in Eastern Europe, Chem-Trend Romania SRL has been established through the acquisition. Chem-Trend Romania will continue to support the local market in the existing industries of polyurethane and rubber molding, thermoplastics processing and die casting and will expand in the future to support the needs of the tire manufacturing market as well.

The new entity was formed with many of the same team that had been servicing release agent customers through Rubio, including one of the former owners of that organization, Ciprian Cristea. "I am very pleased to be involved in the start of Chem-Trend Romania. Our existing sales structure that is now backed by the in-depth technical and operational resources of the global Chem-Trend organization allows us to deliver even greater service to our customers over the longer term," Cristea stated.

"Rubio has long been known for its knowledge of the release agent business combined with excellence in customer service, and Chem-Trend provides industry-leading R&D, global sales, service and manufacturing capabilities. Joining the talents of these very dynamic and complementary organizations will directly enhance the service we offer to our important customers in Eastern Europe," said Paul McGill, executive director sales & marketing, Chem-Trend Europe.

"Chem-Trend is proud to have been active in Eastern Europe for many years. Romania continues to attract a high level of foreign investment and the establishment of Chem-Trend Romania positions us to provide even greater service to our local, regional and global customer base that are located in this strategically important and rapidly expanding market. The addition of this office, along with the many talented and experienced people who have joined us from Rubio, strengthens our commitment to addressing the needs of the local market," said President and CEO Devanir Moraes, Chem-Trend.

About Chem-Trend

Chem-Trend provides end users across various markets with release systems and complementary molding process aids that create enhanced value, efficiency and productivity. Chem-Trend has a global presence with production facilities on four continents, offices or local representatives in 20 countries, and a distribution network covering more than 50 countries. Chem-Trend products are used in a broad range of applications, including composites, rubber and polyurethane molding, high-pressure die casting, thermoplastics processing, wood composite pressing and in the manufacturing of tires. The company's global sales and technical service representatives work on-site with customers to maximize release agent value addition and provide dependable application and processing expertise.