

BUILT IN-HOUSE DELIVERED WITH CONFIDENCE

▶ HOW VERTICAL INTEGRATION IMPROVES PROJECT RELIABILITY AND DELIVERY PREDICTABILITY.

Supply chains have become more complex and more difficult to manage. In this environment, a stable and vertically integrated supply chain can create clear customer value through greater reliability and more consistent quality.

As a manufacturer of heavy-duty pumps, particularly magnetic drive pumps, Klaus Union has developed and refined a vertically integrated approach to address these challenges.

This paper outlines how vertical integration translates into practical customer benefits and why it can be a key factor in reducing project and supply risk.

WHY SUPPLY CHAIN STRUCTURE MATTERS MORE THAN EVER

While supply chain disruptions are often associated with high-tech sectors such as semiconductors or just in time manufacturers such as e.g. cars, they also affect more traditional industrial businesses, including pump manufacturers. At the same time, applications are becoming more demanding, while expectations for equipment reliability remain high. Meeting these dual challenges requires a supplier with a supply chain that is both robust, flexible and reliable.



WHAT VERTICAL INTEGRATION MEANS FOR KLAUS UNION

Vertical integration is a term that is often used broadly. For Klaus Union, it has a clear practical meaning:

- ▶ Maintaining consistent quality by keeping critical production and product know-how in-house
- ▶ Maintaining an agile structure that can respond to changing customer requirements without compromising reliability
- ▶ Maintaining robust stock levels to absorb short- and medium-term disruptions in critical supplies without affecting on-time delivery or product quality

In summary, the goal is to sustain critical production capability and use it to ensure consistent quality and reliable delivery.



OUR QUALITY IS YOUR SUCCESS

KLAUS UNION SUPPLY CHAIN FRAMEWORK

To support this approach, Klaus Union continuously evaluates products and processes based on their technical characteristics and the potential impact of supply disruptions.

CATEGORY	SUPPLY PROFILE	TYPICAL EXAMPLES	KLAUS UNION APPROACH
STANDARDIZED / ROBUST	Robust supply, multiple sources	Bearings, Gaskets, O-Rings	Strategic stock, supplier monitoring, incoming quality control
ENGINEERED / ROBUST	Robust supply, multiple qualified sources	Motors, Couplings, Instrumentation	Approved suppliers, audits, close technical coordination
STANDARDIZED / CONSTRAINED	Limited sources or vulnerable supply	Ceramics, Magnets	Standardization, dual sourcing where possible, high stock, in-house substitution know-how
ENGINEERED / CONSTRAINED	Limited substitution, vulnerable supply	Castings, Welding, Critical Machining, Quality Control	Deep vertical integration, retained expertise, close cross-functional control

- ▶ The greatest value is created in the categories “Standardized / Constrained” and “Engineered / Constrained,” where supply constraints, technical complexity, or limited substitutability require deeper control.

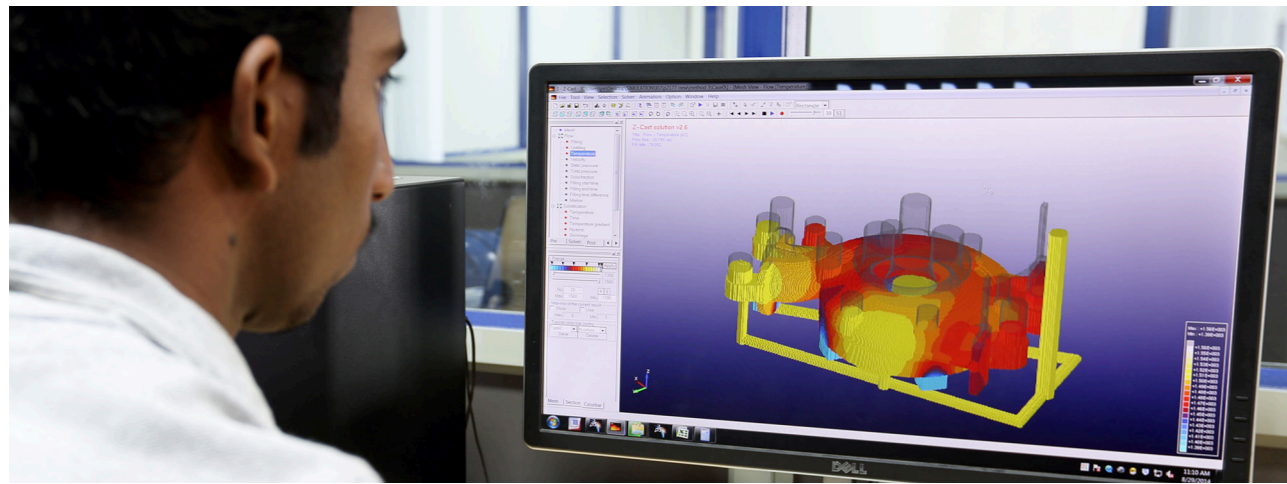
STANDARDIZED / ROBUST

These parts can be substituted without affecting quality or technical reliability. Typical examples include bearings, standard hardware, and O-rings. Standardization and inventory support continuity of supply, while a broad supplier base allows sourcing flexibility. Secure stock levels and incoming inspection are the principal tools used to avoid disruptions.

ENGINEERED / ROBUST

These are products designed to customer specifications or requiring customer approval. A broad and qualified supplier base, supported by close supplier oversight and auditing, is the primary tool used to ensure quality and continuity of supply. Strong technical documentation and feedback loops support continuous improvement in both quality and responsiveness.





STANDARDIZED / CONSTRAINED

These parts often appear at first glance to be simple standard components. In practice, however, they may still be difficult to replace due to a limited supplier base, geopolitical exposure, or lengthy requalification efforts. Typical examples at Klaus Union include technical ceramics and magnetic materials. Standardization, in-depth engineering know-how, and extended stock coverage are the primary tools used to manage continuity of supply.

► **TECHNICAL CERAMICS**

At first glance, ceramic materials may appear to fall into the “Standardized / Robust” category. In practice, however, the supplier base for high-performance ceramics is relatively limited. Dependence on single sourcing should therefore be avoided. Klaus Union addresses this by applying as much standardization as possible in design while maintaining significant stock to ensure continuity of supply.

► **MAGNETS**

On the surface, magnets may appear to be easy to source from multiple suppliers, making them seem similar to a “Standardized / Robust” component. In practice, however, the concentration of rare earth supply in a single region makes this category far more constrained than it first appears.

KLAUS UNION ADDRESSES THIS IN THREE WAYS:

First, we maintain the full in-house capability required to design, specify, and evaluate magnetic components. This allows substitutions to be assessed, specifications to be adapted, and the impact of any changes to be evaluated across the full product range. To support this, Klaus Union maintains a suite of tools for simulating magnetic fields under both stationary and transient conditions.

Second, we minimize dependence on externally sourced assemblies. Klaus Union sources the magnets themselves, while building the complete magnet drives in-house, maximizing flexibility in the use of available stock.

Third, we maintain high stock levels for magnetic raw materials. These stocks are sufficient to cover multiple years of demand without new supplies, with internal targets extending well beyond five years of rolling demand.

► Together, these measures help ensure Klaus Union can continue to serve its customers even during periods of supply interruption, without compromising performance or reliability.



ENGINEERED / CONSTRAINED

The final segment includes products and processes that are particularly critical due to their technical complexity, limited substitutability, or impact on performance and reliability. This is where vertical integration shows its greatest value. Castings, welding operations on highly alloyed materials, critical machining steps, and inspection are all areas in which Klaus Union’s approach offers substantial advantages.

► **CASTINGS AND ASSORTED DESIGN WORK**

Pump castings are often demanding due to the nature of their applications. This may involve exotic alloys or particularly stringent quality requirements. Because these castings are frequently custom designed, produced in relatively small quantities, and subject to ongoing process improvements, external foundries do not always treat them as priority business. Even when such work is accepted, it may be downgraded from an “A” priority to a less urgent “B” or “C” job.

At the same time, the relatively small lot sizes typical of heavy-duty pumps make this type of business difficult to position as a priority at major foundries, especially when customer- or application-specific quality requirements must also be considered.

A shift from “Priority A” to “Priority C” — whether because larger-volume work takes precedence or because process improvements require changes to existing patterns — can quickly lead to serious delivery issues.

In contrast, small lot sizes and the need to update designs or patterns are part of normal operations in Klaus Union’s own foundry. This allows process improvements to be implemented more quickly and reliably than would typically be possible when relying on an external foundry.

In addition, close cooperation between foundry and design engineers ensures that casting requirements are addressed early, while production feedback flows directly back into the design process.

► **WELDING CAPABILITY FOR CRITICAL HIGH ALLOYED COMPONENTS**

Few things can compromise good materials as effectively as a poor welding process. This becomes even more critical when working with highly alloyed steel, where welding has a direct influence on corrosion resistance and service life. The same material requirements that make components demanding in casting also make them demanding in welding.

An additional challenge is that weld qualification and execution cannot always be treated as separate matters. This is especially true for complex weld geometries, difficult heat treatments, or customer-specific requirements. In



such cases, maintaining in-house expertise and practical process experience becomes particularly important. Because Klaus Union routinely works with highly alloyed steels, it is essential for us to understand welding requirements and their impact on material treatment, machining, and testing. It is equally important to optimize designs for reliable, high-quality weldability from the earliest stages.

► **MACHINING OF PERFORMANCE CRITICAL COMPONENTS**

Pump parts are not always the most intuitive parts to machine. Some tolerances seem ridiculously small, but are essential to ensure performance and reliability of equipment. On the other hand, sometimes changes in machining that are difficult or impossible to detect can have an impact on material performance. For this reason, Klaus Union minimizes outside production of performance or safety critical parts. This way an established quality and tracking system ensures not only timely delivery with consistently high quality, but continuous implementation of improvements and feedback loops.



QUALITY CONTROL PROCEDURES AND EVALUATION

Klaus Union treats quality assurance as a core paramount requirement for long-term customer success. To support this, we have for decades maintained our own in-house ISO 9712 Level 3 qualified inspectors, who oversee, train, and guide personnel and processes across quality-related activities. This helps ensure that inspection expertise remains closely connected to production, process control, and continuous improvement.

Although pump casings are not classified as pressure vessels under the Pressure Equipment Directive (PED), their design, machining, and quality requirements must be approached with the same level of care. For this reason, Klaus Union maintains welding and design qualifications aligned with PED-related standards. This helps ensure that critical manufacturing processes remain consistent with demanding, high-integrity production requirements.



WHY OUR VERTICAL INTEGRATION CONTRIBUTES TO YOUR SUCCESS

Klaus Union's vertically integrated operating model delivers direct and practical benefits to customers. By retaining control over critical processes and know-how, we reduce supply-chain risk, strengthen quality assurance, and improve responsiveness when requirements change. This helps us deliver reliable products on schedule, maintain the quality standards demanded by hazardous-duty applications, and execute even complex retrofit projects within challenging timelines.

REDUCED SUPPLY CHAIN RISK

By having key components in our own hands and having large stocks of those components where this is not possible, we minimize our external dependencies. This hardens our supply chain against volatile or disrupted markets, ensuring we remain a stable partner to our customers even when global pandemics or regional conflicts raise concerns and create global delays. This continuity gives peace of mind to our partners during long-running projects, reducing your risk of delays or prohibitive cost increases even under adverse global conditions. And above all this ensures the possibility for emergency help, before a plant shut down takes place.

BETTER QUALITY CONTROL

The vertical integrated structure ensures we have few interfaces where traceability can be maintained only with difficulty. It is further enhanced by a single governing ERP and documentation system that ensures we can reliably trace the life of a product from the earliest stages – like the pour of a heat in the foundry – to the final product, down the level of individual operations. This allows us to detect problems early and assist customers with root cause analysis for products for decades in service. At the same time, it allows us to establish quality controls where they are most efficient to ensure we really produce – and not test – quality.

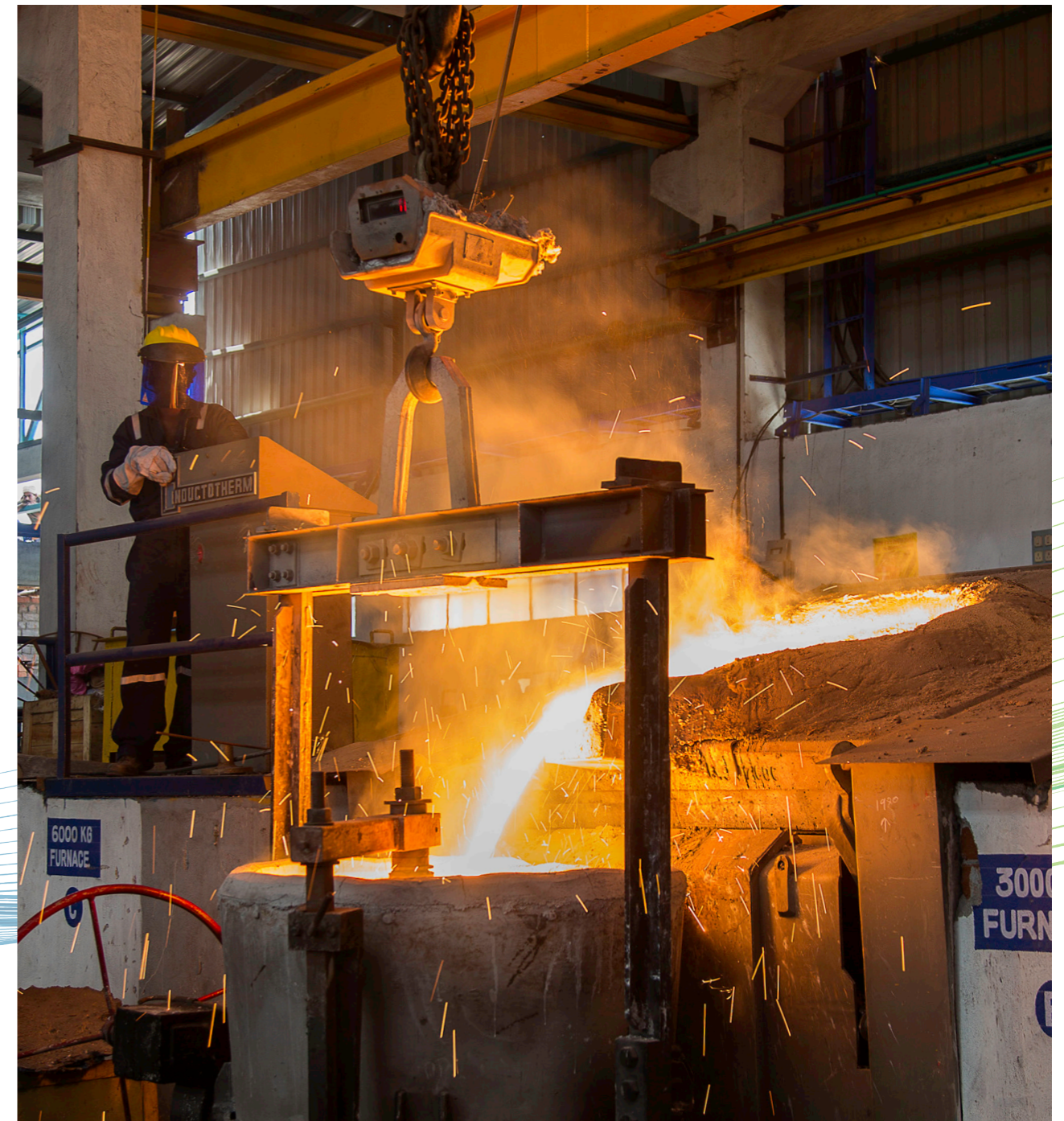
FASTER RESPONSES AND CLEARER COMMUNICATION

Change happens. In long-running projects this holds especially true. A more fragmented organization with various suppliers needs to coordinate many parties, assess impact on changes and agree on commercial impacts before finally reverting with a compiled change impact to customers.

Our vertically integrated organization on the other hand aligns priorities across all levels of the organization, reducing friction and interfaces and allowing a more agile reaction to change in project requirements, establish impacts and cleanly implement required changes to minimize impacts on schedules and prices.

BETTER IMPLEMENTATION OF FEEDBACK

The most critical advantage of this vertical integration concerns information flow – both “down” the chain ensuring intent of design is preserved from the engineering down to assembly, manufacturing and even pattern making, but also “up” the chain implementing customer feedback on reliability, test results, manufacturability, quality control and assurance up to castability. A tight alignment all the way through the organization with few interfaces and well-integrated systems ensures a free flow of information where required. This minimizes misunderstandings, enhances reliability and lets us serve the customer with better quality and precision.



CASE STUDIES

Above paragraphs laid out the Klaus Union understanding and approach to vertical integration. The following two cases illustrate the very real benefits delivered to customers thanks to our integrated operating model.

RETROFIT PUMPS AND PARTS

In this instance, we leveraged the efficiency and responsiveness facilitated by our vertical integration.

► THE CHALLENGE

A customer challenged us to supply retrofit parts in the time it would usually take to supply standard parts – 16 weeks.

► OUR RESPONSE

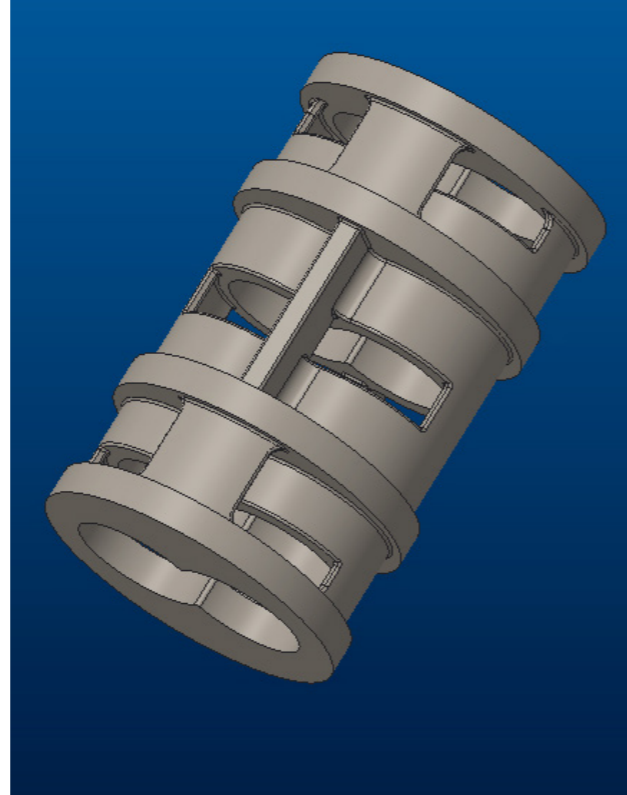
During the pre-order stage we could efficiently evaluate customer requirements and ensure we could meet the challenge. After receipt of the purchase order a working group consisting of experts from our foundry, machine shop and product engineers studied the required retrofit parts. Utilizing 3D CFD analysis tools at the foundry level we could simulate the casting process and identify potential areas of defects. This allowed us to implement required changes at the earliest design stage, where simple adaptations could improve the pouring, solidification and cooling down properties and thus reduce the risk of casting defects.

Our CAD/CAM experts from the machine shop could contribute with required casting allowances to minimize subsequent machine time.

The collaboration of the product experts ensured the intent and purpose of the design and drawing tolerances was understood by all involved parties and kept in mind during the optimization process.

► RESULT

The project could be tightly scheduled as all stations had a clear view of the current production stage, ensuring that tools were ready for machining when the raw parts arrived so downtime was minimal and we could keep the customers' tight deadline.



IMPLEMENTATION OF WEAR RESISTANT UPGRADES

In this case we had to retrace the history and prior modifications on a pump that was already in the field for more than two decades – and to deliver a product adapted to the customer's changed needs to enhance reliability and maintainability.

► THE CHALLENGE

A customer in the chemical industry approached us regarding a pump more than 20 years old, that was experiencing wear on the impeller and even on the casing itself.

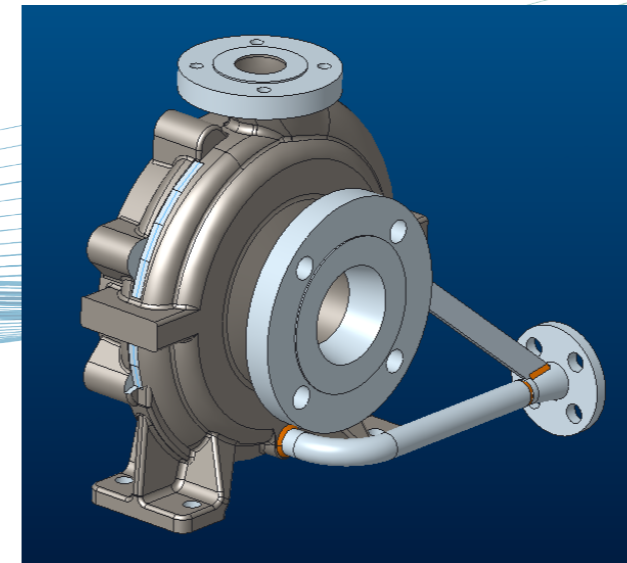
The customer requested both an upgrade in reliability and to improve ability to measure casing wear to have sufficient early warning time to shut down the pump in a controlled manner, before the casing wear could lead to product leakage to the atmosphere.

► OUR RESPONSE

A casing with increased wall thickness was delivered with special geometry that allowed the customers' maintenance teams to conduct reliable in-process wall-thickness measurements to monitor casing wear. At the same time the impeller and internals were upgraded with a different material grade that could then be additionally nitrogen hardened, increasing wear resistance.

► RESULT

Customer's field experience shows that even after the modified pump was twice as long in operation as the previous design it showed no drop in efficiency. An inspection was conducted anyway to assess performance of the enhanced parts, and showed that the impeller wear was substantially reduced, showing only traces where the old impeller used to be worn out at half the operation time. This reduced customers' spare part costs and downtime directly improving output and customers earnings.



CONCLUSION

Vertical integration is not an end. Its value lies in the practical advantages it creates for customers. By combining critical engineering, sourcing, manufacturing, and quality capabilities within one closely connected operating model, Klaus Union reduces dependency on fragile external supply chains, improves control over technically demanding processes, and responds more effectively to changing project requirements. This is especially important where hazardous media, complex materials, demanding service conditions, or legacy equipment place a premium on reliability and execution. In these situations, vertical integration supports not only consistent product quality, but also greater predictability, faster problem-solving, and a stronger ability to deliver fit-for-purpose solutions on time.

