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Tool Steel: Balancing The Productivity

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EDITORIAL



Let's Reinvent!

he 1966 World Cup turned out to be a low point for Brazilian soccer. After winning the two previous tournaments, the team was eliminated in the first round, and Pelé, the star player failed to perform. Such was the effect that Pelé threatened never to return to the World Cup. Fans wondered if Brazil's glory days were over. However, four years later, Brazil won again. Pelé was named the player of the tournament and the 1970 team is widely regarded as the best team ever.

But how did this change happen, what worked for the team? The answer is innovation leading to the creation of a unique attacking style of soccer. It required building a cohesive team and leadership, both in management and on the field. Brazil came back stronger by reimagining everything.

Something that now the Indian tooling industry also needs.

Apart from a few slowdowns, the Indian tooling industry has been growing for a long time. However, the current global lockdown because of COVID-19 has hit the industry hard. We are all clueless about business prospects. There has been practically no operation for a month or so and in the future, we might be able to open with limited capacity. There is no business, but we still have to pay salaries, meet EMI deadlines, pay taxes, deal with low cashflow, it means we have to deal with several challenges at once.

Nothing can be worse than the current situation. So what do we do now? Let's reinvent ourselves like the 1970 Brazil soccer team. Let's change our management style, let's prepare ourselves for the post-COVID situation, let's adopt technologies that are more sustainable and most importantly, let's diversify and work together. If we carefully see the trend, after every slowdown there is huge economic growth, let's be prepared to take the bigger pie of the growth.

With this, I present to you the March edition of the TAGMA Times that focuses on Tool Steel.

Also, feel free to share more interesting topics that you would want to read about.

Stay Healthy, Stay Safe!

Nishant Kashyap Editor nishant@antechmedia.in

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Industry Update

COVID-19 & MANUFACTURING

Jyoti CNC has developed and launched indigenous ventilator within 10 days

THE world is facing a massive challenge in the form of COVID-19 virus. Due to the high human to human transfer rate the virus has already spread in all countries around the world with over a million cases and total deaths crossing 60,000. In India government has been an early starter in proactively preparing to face the pandemic challenge.

In a meeting of state government, the officials of Government of Gujarat had expressed the availability of Ventilator in limited quantities as one of the major upcoming bottleneck if the spread of COVID-19 disease caused by corona virus crosses a threshold. Currently, Gujarat State has 1061 ventilators available. Looking to the way ventilators were outnumbered by number of COVID-19 patients in developing economies like Italy and New York, availability of limited quantity of ventilators was a major worry for the government. The fact, that creating a precision instrument like ventilator required high technical know-how, many parts imported from foreign countries and long production cycle, makes it a tough task to ramp up the number of ventilators in state.

It took the courage and vision of a person from a third tyre city of India,

to take up this tough challenge. Parakramsinh Jadeja founded Jyoti CNC limited is known for it's insight and revolutionary intelligent contribution to the country's machine tool industry. It was a tough call for Jadeja who is the Chairman and Managing Director of the



company that employs around 2000 people. Without in-depth knowledge of the medical industry, Jadeja led Jyoti CNC in the race against time to help the nation.

The first prototype of Ventilator that is suitable to treat a Covid-19 patient was made ready in working in 10 days flat. Leading from the front Parakramsinh and his team of 150 professionals worked round the clock during this 10 days. While sizeable contribution came from the wide industry knowhow and experience of Rajendrasinh Parmar (RHP Medical), there were other 26 allied companies that worked relentlessly to complete the task they were assigned. Jyoti's production units in Rajkot charted out the designs and manufactured critical components.

The 100% indigenous ventilator was given the name Dhaman-1, as 'dhaman' translates to a blower that pumps air. After thorough testing of the ventilator at Gujarat government's Electronics and Quality Development Center laboratory, the machine was tested on live patient at Civil Hospital, Ahmedabad. The indigenous ventilator was later formally launched by the Chief Minister of state Mr. Vijay Rupani.

With an objective to contribute towards helping the government working in this testing times of crisis - Jyoti CNC will donate the first 1000 'Made in India' ventilators to the government. The company will bear all the manufacturing cost and production overheads for this 1000 pieces. This first 1000 devices would br manufactured by the company in a span of 10 days. Jyoti CNC has indeed set an example of sorts for the first time in the history of this country.

SIAM on Corona Virus impact on Automobile industry in India

MR Rajan Wadhera, President, SIAM in a brief statement issued to the Media highlighted that many automakers in India import about 10% of their raw materials from China. The disruption in availability of these parts are likely to critically hamper production across all segments, namely Passenger Vehicles (PV), Commercial Vehicles (CV),

Three-Wheelers (3W), Two-Wheelers (2W) and gravely affecting Electric Vehicles (EVs).

Mr Wadhera further emphasized that with anticipation of the Chinese New Year, Indian Auto Industry had maintained inventory in beginning of the year, but with the current lockdown in China, supply for BSVI vehicles is likely to get impacted. Manufacturers are exploring alternatives to fulfil their supply chain demands but that would also take a substantial amount of time to reach stable production scale as these components would need regulatory testing, reiterated Mr Wadhera.



the Auto Industry and in this regard, Industry is particularly thankful to the Government for issuing a notification of Force Majeure for Corona virus and also 24x7 clearance of shipments at all customs formations.

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Industry Update

ACMA seeks relief measures for the component industry to withstand COVID 19 impact

- Creates taskforce to evaluate the possibility of manufacturing facemasks,hand-sanitisers by auto component companies
- Industry committed to be empathetic to employees, over 1 lakh contractualemployees already received salary for the month of March

The impact of Coronavirus over the industry, people and the economy is a grave concern. Given the unprecedented situation, the auto component industry is trying to mobilise all possible resources and assets that can help the Government and frontline workers fight the pandemic.

The Automotive Component Manufacturers Association (ACMA) has created a taskforce which is evaluating the possibility of manufacture of facemasks, hand-sanitisers by its members. Several of the component companies have shown keen interest to manufacture these items. Specifically, for ventilators, members are evaluating the option to import them through their CSR funds. The industry also seeks guidance from government on the standards for such equipment and the quantity needed.

ACMA has issued an advisory to all its members to maintain safety & security of all permanent and contractual employees, ensuring no layoffs and timely salary for the month of March. In fact, over 1 lakh contractual employees have already been paid their salary for the month of March. Further, several of the component manufacturers have promised to extend full medical aid to their employees, including contractual, in the eventuality of them or their family members contracting the Novel Coronavirus. Many auto component companies are also running community kitchens, with all necessary norms

of social distancing, to ensure their contractual employees get regular food.

Commenting on this situation Mr. Deepak Jain, President ACMA, said, "These are indeed unprecedented times, and I thank our Prime Minister for his exemplary leadership in announcing timely measures to control the speared of COVID-19 pandemic in India as also the recent measures announced by the Finance Minister and RBI Governor. The Auto Component industry stands by the Government of India in this hour of challenge. However, with complete stoppage of production in the vehicle industry and scarcity of working capital, the situation in the component



manufacturing units, including the tier-2s and tier-3s has become quite acute, threatening their survival. We have requested the government for helping us with immediate relaxation of borrowing norms & statutory payments, extension of moratorium on payment of principal and interest of loans for a year, among others. We are also seeking support of SIAM and the OEMs to ensure minimal disruption of the supply chain."

There is no denying that the automotive industry in India has already been reeling under significant pressure to cope with plummeting vehicle sales for over a year now as also transitioning from BSIV to BS VI. The industry is now faced with the onslaught of a much bigger challenge of the COVID-19 pandemic which now threatens to destabilize the entire automotive value chain. The situation is even worse for small and medium firms whosesolvency is being challenged. To avoid such a scenario, ACMA has requested for the following:

- Support for Working Capital Relaxation of borrowing norms & statutory payments
- Norms for NPA recognition to be eased by extending moratorium on payment of principal and interest by at least 1 year
- **••** Relaxation in fixed electricity charge
- Relaxation in of levy demurrage charges for at least 7 days for import cargo clearance

With a three-week lockdown announced by the Government, production has come to a standstill in the automotive industry across the country. Auto Component manufacturers, especially the Tier-2s and Tier-3s are facing severe hardship on front of cash flow, which if not immediately addressed will lead to insolvency of several companies, especially the Tier-2s and Tier-3s. Further, there is no clarity on how the market will pan out in the ensuing months, thus further eroding the industry's confidence. It is estimated that the component sector is facing production loss of INR 1,000 - 1,200 crore per day.

The Auto Component Industry contributes 2.3% to India's National GDP, 25% to national Manufacturing GDP and employs over 50 lakh people. In 2018-19, the turnover of the industry stood at USD 57 billion with USD 15 billion in exports. The sector exports to almost all of world's leading vehicle manufacturers and Tier 1s, which speaks of its strong capabilities and global competence. The industry dominated by SMEs, is one of the key drivers of India's economic growth and the 'Make in India' program.



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Industry Update

CII Sets up Fund for MSME to Tackle Covid-19

THE Confederation of Indian Industry (CII) has announced setting up of a CII COVID Rehabilitation and Relief Fund (CRR) to assist small enterprises or MSME in rehabilitation. This decision was taken by a CII Forum on Covid-19 which is leading industry response measures to the Coronavirus pandemic.

Following widespread discussions with MSME members across the country, specific measures have been suggested by CII to curtail the impact of Coronavirus on the MSME sector. "Multiple actions need to be taken on extension of bank loans, a special fund, steps regarding filing of GST and improving welfare of workers. CII stands ready to support MSME sector in this hour of need through the CII COVID Rehabilitation and Relief Fund," stated Mr Shreekant Somany, Chairman, CII National Council on MSME.

With MSME facing a cash crunch, CII requested for additional ad-hoc sanction of working capital to the tune of 25% of sanctioned limit as a relief measure. The industry body suggested deferment of EMIs and interest rate on

working capital as well. Setting up of a special MSME Factoring fund to enable MSMEs to discount their bills to approved retailers in 15 days and permit retailers to pay in 120 days would help in faster realization, said CII.

Creation of a corpus by the Government to help

MSMEs tide over the crisis would help them to pay wages, according to CII. Extension of NPA norms in genuine cases to 150 days from the present 90 days and if required by industry, ad-hoc limits to an extent of 25% of sanctioned limits may be allowed by banks on SOS basis to overcome temporary liquidity crunch, would also provide temporary relief, said CII.

Measures for improving welfare of the MSME workers during the temporary shutdown period are required as well, said CII. Some of these could include supporting laid off workers during the crisis period, handling the statutory compliance of compensating workers in case of shutdown and exploring insurance cover options through the Employee State Insurance Corporation (ESIC), 90 days extension for payment of Employer's contribution of PF and ESIS, Insurance cover or part financing wages for those laid off due to Corona Virus through ESIC or new Govt Schemes, allowing of CSR funds to support payment of wages to laid off Workers, among others.

Other measures such as, extension of period for declaring NPAs by MSMEs, allowing roll over of terms loans and implementation of moratorium on EMIs for industrial loans and faster tax refunds, allowing banks to extend credit limit for MSMEs by 20% at branch level, among others could significantly ease liquidity and other pressures on the sector and help the sector cope with the current crisis, said CII.

It has been further proposed by CII that the Government should draw up contingency plans for three periods – Till 31 March; for Next 2 months till 31 May and then for Next 2 months till 31 July. There should be close monitoring of Payment Delays by CPSUs to MSMEs through a portal for complaints and necessary funds are provided and utilized for this purpose should be ensured, banks should be allowed to extend existing Credit Limits for MSMEs by 20 % at Branch Level. Relief should be provided so that credit rating of Brands and Retailers is not adversely affected due to delays in repayment of bank loans, interest, EMI, etc together with ensuring that no punitive action is taken by NCLT for delays of repayments etc. till 31st December 2020, added CII.

CII has 67% of its membership as SME and works closely with the Ministry of MSME. CII organized a special virtual meeting for its SME members on assessing the impact of Covid-19 in their businesses and also bring out suggestions to mitigate

the adverse impact. Over 100 MSME members from across India participated representing sectors of auto components, light engineering, forging, electronics, ceramics, construction equipment, décor solutions, financial services, pharmaceuticals, chemicals, IT & ITeS, etc.

The Micro, Small and Medium Enterprises (MSME) sector is one of the most severely affected sectors, amidst the ongoing Coronavirus (Covid-19) crisis. Many steps to curtail the outbreak such as travel bans, closure of malls, theatres and educational institutions have led to widespread disruptions in economic activity, which in turn has hampered the business operations of the MSMEs.





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Industry Update

Face Shields Developed to Fight COVID-19 @ GNA University

GNA University in association with the Stratasys & DesignTech Systems took a grave initiative to develop and test 3D printable Face Shields. When the entire world is at war with the coronavirus COVID 19, Faculty of Engineering Design & Automation -Design Department is there to assist the medical community in the fight against COVID-19. GNA University is leveraging 3D printing technology to make face shields for the doctors, medical professionals



and all other staff to reduce the shortage of such equipment in the wake of the novel coronavirus pandemic.

GNA University is taking a two-phase approach of Design and Development and has developed a reusable face shield in the Stratasys 3D printer consisting of a 3D print frame, a face shield cut, a piece of form and an off-the-shelf elastic band. This shield can be removed and replaced within seconds.

Mr. C.R.Tripathy, Dean Faculty of Engineering Design & Automation said, "We develop Face Shield in our 3D Printer Lab and our team is whole-heartedly working on an injection mould that will mass-produce these face shields and keep up with the soaring demand."

S. Gurdeep Singh Sihra, CEO GNA Gears & Pro-Chancellor, GNA University expressed, "Transmission of the Covid-19 does not only transpire through nose and mouth, but also through droplets that enter our eyes. The designed shield can break that from happening and can decrease the droplets from dropping on the masks. Not only did we developthis face shield in 3D printer machine, but also developed many other valuable projects in this machine being used worldwide."

He also said, "This Face Shied can be successfully used by Doctors, Healthcare Workers and Medical professionals while

treating COVID 19 positive patients. This can be also used by the Security persons, Housekeeping staffs, Defence persons, drivers of the ambulance and office staffs who are in direct communion with the people to save them against the COVID19."

S. Gurdeep Singh Sihra also commented, "GNA University is duly focused n providing Rapid Prototyping technology (Stratasys 3D Printer) at the earlier stage to the students in their educational journey."

Dr. V.K. Rattan, Vice Chancellor- GNA University,Dr. Monika Hanspal, Dean Academics and Dr.Sameer Varma congratulated the Team for their efforts in the field of research and development during the on-going Lockdown.

Dr. V.K. Rattan, Vice Chancellor- GNA University said,"GNA University is always making persistent efforts towards providing latest technologies to the budding engineers which will help them in achieving their desired goals."

Hexagon supports manufacturing professionals working from home with access to its smart manufacturing solution portfolio

Free offline licensing and remote access options to help manufacturers remain productive while working from home

Hexagon's Manufacturing Intelligence division is offering a range of free offline licensing and remote access options designed to enable efficient home working for manufacturing professionals facing new productivity challenges during the COVID-19 outbreak.

Home working options will be provided for Hexagon's production software and metrology software offerings, as well as the MSC Software range of CAE solutions, until at least June 30, 2020. Manufacturers running metrology



equipment in factories can remotely monitor and analyze how key assets are performing for free with HxGN SFx | Asset Management. Users will also have access to additional online learning resources.

"The purpose of our smart manufacturing solutions is to improve quality and productivity and this challenge is especially acute during this time of extensive home working," said Paolo Guglielmini, president of Hexagon's Manufacturing Intelligence division. "So, to support the industries we serve, we're offering special access to our software and learning tools for both current customers and noncustomers who can benefit from our technology.""Like many businesses in the manufacturing sector, we have many employees working from home at the moment and we appreciate that giving them the right tools to work remotely is essential to their wellbeing and success. By offering learning and remote-working solutions, I hope we can contribute to maintaining productivity and quality while keeping employees in manufacturing safe."





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Technology Update

Latest additions strengthen die and mold capabilities

IN recent years, global manufacturer Dormer Pramet has expanded its assortment of indexable and solid round tools to support a variety of die and mold applications.

This diverse industry features a wide array of molding components, often featuring materials in a condition that makes them difficult to machine, with a requirement for tools capable of supporting high feeds, as well as large material removal rates.

Common components include plastic injection molds, forging dies, die casting and micro molds, with each requiring application specific tooling. This range of applications covers heavy roughing through to fine finishing.

Dormer Pramet works with a wide range of die and mold manufacturers, from companies making small components, such as molds for bottles and mobile



phone cases, up to large forgings. Workpieces are often made from difficult to machine materials, such as prehardened steel, hardened tool steel and stainless steel.

The most typical include P20, H13 and D2 tool steel materials, based on international standards. P20 is a versatile, low-alloy material which offers good levels of toughness and moderate strength. It is commonly used for plastic injection molds and die castings.

A versatile chromium-molybdenum material, H13 is suitable for applications

where temperatures fluctuate during the machining process. It resists thermal fatigue and cracking which can occur when creating the molds at different stages.

Finally, D2 is high carbon and chromium tool steel, which exhibits good levels of wear and abrasion resistant properties. It is generally heat-treated to a hardness of around 62 HRC, where it can still be machined using the correct tools and machining strategies. The high levels of chromium give it a medium level of corrosion resistance when hardened.

With the many different workpiece materials and variety of sizes involving several machining operations, having the right cutting tools is paramount. Dormer Pramet offers numerous standard and special tools - primarily milling cutters – to support the production of small batch quantities for specific applications.

The New Solid Carbide Drill with SGL-Point Geometry

KENNAMETAL brings unprecedented drilling success to manufacturers in the aerospace, and energy industries.

Kennametal today introduces another high-performance cutting tool, the B21*SGL solid carbide drill with coolantthrough. Designed for stainless steel, nickel and cobalt-based alloys, the B21*SGL with patented point geometry and monolayer PVD AITiN coating, delivers improved productivity and longer tool life for aerospace and energy applications requiring predictable, highproduction drilling.

"In customer tests, the B21*SGL consistently outperforms competing drills, producing more holes in less time, with improved hole straightness and surface quality.

The new design virtually eliminates the risk of chipping and flaking that lead to drill failure. And thanks to a unique point gash, it offers the lowest thrust level on the market, enabling productive drilling even in delicate workpiece geometries", said Frank Martin, Product Manager, Solid Carbide Drills.

One of the problems with these materials is their tendency to stick to the cutting tool, leading to built-up edge and corner

chipping. The B21*SGL's proprietary gash geometry, polished cutting edge, negative rake corner margin, and "chip-friendly" flute design mitigates these effects, while encouraging chip evacuation and reducing cutting forces. Add to that Kennametal's extremely wear-resistant, high aluminum content KCMS15 grade and you have a drill that not only makes more holes per tool but does so more quickly and predictably.



"A number of our customers have seen tool life improve by two to six times in a variety of challenging materials, even after increasing feed rates by up to 50% in some cases," said Martin.

Holemaking is a critical machining process, especially so for those producing turbines. Because the drilling operation typically comes near the end of the production cycle, when workpieces are at maximum value, a broken

drill can damage or even destroy components worth tens of thousands of dollars. "This new solid carbide drill will bring incredible value to anyone needing to drill large numbers of holes in Inconel, titanium, PH-series stainless steels, and other heat-resistant superalloys. Especially relevant to aerospace manufacturers, given the tremendous pressure to ramp up production of the LEAP aircraft engine program", said Matthieu Guillon, Key Account Manager, Aerospace.



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Technology Update

Schunk launches versatile clamping force tester

SCHUNK'S new versatile clamping force tester is designed to regularly check and ensure maximum process safety and efficiency of lathe chuck in daily use.

It can be used on 2, 3, and 6-jaw chucks up to 6,000 RPM regardless of the chuck manufacturer, and at a maximum clamping force of 90 kN per jaw. Adjustable measuring extensions allow variations in clamping diameters between 72 mm, 88 mm, and 108 mm. Data evaluation is done with wireless data transfer with an app on a tablet computer or with other terminals. The battery life of the measuring head is more than 90 minutes, and it takes less than 3 minutes to recharge. The clamping force tester can be used for static measurement such as determining loss in clamping force under speed, or for individual adjustment of the required initial clamping force



for individual machining operations. SCHUNK recommends regularly checking the clamping force at the beginning of a serial operation, and also between the maintenance intervals again and again. It is the regular verification that ensures the optimal safety. If possible, the clamping force should be measured in a state that is how the lathe chuck is used in an individual clamping situation. If for example, top jaws with clamping steps are used, the operator should measure the clamping force in the same way on the same jaw step as he will apply it to the workpiece later. If the measurement reveals that the clamping force is below the target value, SCHUNK recommends that the operator intervene immediately to ensure safety of the ongoing operation. Depending on the condition of the lathe chuck, it is appropriate either to lubricate the lathe chuck or to completely disassemble, clean, and then lubricate it.

Hoffmann Group launches "GARANT Master Alu" series for high-performance cutting of aluminium

WITH its new "GARANT Master Alu", the Hoffmann Group is launching a completely redeveloped line of solid carbide milling cutters, designed for high-performance cutting of aluminium.

As such, customers can now also benefit from the particular performance, process reliability and efficiency of the topclass "GARANT Master" cutters when machining aluminium, as well. This

range was established in 2015 with the introduction of the "GARANT Master Steel" solid carbide milling cutter and includes high-performance milling cutters for steel, stainless steel, titanium and aluminium, as well as various highperformance drills.

The new "GARANT Master Alu" line of solid carbide milling cutters has been designed to maximise precision and cope with the most stringent highperformance cutting requirements. The range has tools to handle any application: a balanced single-cutter milling cutter, a finishing cutter, a roughing end mill with knuckle profile (SlotMachine) and a pocket milling cutter (PickPocket) – the latter also comes as a torus cutter. The single-cutter "GARANT Master Alu solid carbide milling cutter" is precision



balanced using a newly developed process, in order to optimise chip evacuation and ensure a smooth cutting action. With a balancing quality of G 1.8, it achieves

optimum performance figures at high speeds. In contrast, the "GARANT Master Alu PickPocket" pocket milling cutter achieves maximum feed rates, as does the "GARANT Master Alu SlotMachine" roughing end mill with knuckle profile, which was designed specifically for slot milling. Wet machining is also required in most cases, which is why the tools are also optionally available with throughcoolant. What's more, as a result of their patented end face geometry, the pocket milling cutter and the roughing end mill with knuckle profile aren't just able to be used for ramping and helix milling, they can even handle plunging (drilling).

Hexagon launches entry-level optical CMM for the Asia-Pacific region

HEXAGON'S Manufacturing Intelligence division today announced the launch of Captura, an entry-level optical coordinate measuring machine (CMM) that offers an intuitive and cost-effective solution for multisensor measurement of small to medium parts.



Captura supports measurements using vision sensors, laser sensors and confocal sensors, and is designed to offer good price to performance ratio for the entry-level market. The basic machine is supplied with a vision sensor and can be expanded with additional sensors. The dynamic machine concept offers high positioning accuracy, fast measuring point acquisition, and highperformance vision capturing. Captura CMMs run the Metus metrology software, a Hexagon-developed package for 2.5D multisensor measurement.

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In Focus

Tool Steel: Balancing The **Productivity**



any industries such as medical, pharmaceutical, aerospace, consumer goods, etc place strict requirements on the acceptance level of surface defects that may appear on a plastic moulded part. After all, any defect that appears on the surface of the mould steel is likely to be replicated onto the moulded part. This makes the selection of right steel grades very important to different applications.

How to select mould steel?

The choice of mould steel is of great importance if the mould is to function effectively. When plastic is moulded, due to molecular stretching and shearing, residual stress is left in the product, which causes the product to warp and even crack. Residual stress is also generated during the machining of the mould steel. This residual stress also causes the mould to deform or even crack.

In Focus

The prime function of any mould steel must be that of meeting the service requirements imposed upon it. Moulding requirements vary, e.g. from simple prototype work undertaken on soft aluminium construction moulds, to fully hardened alloy steel volume production moulds moulding to close dimensional tolerances.

In order to avoid costly long-term mistakes, the plastic mould application must be thoroughly investigated and fully understood before a selection decision can be made. Once decided upon, the selected material should be written into the tooling specification for future procurement purposes.

The use of a tooling specification laying out the mould requirements prior to tool quotation or construction greatly reduces the risk of fundamental mistakes being made at the toolmaking stage.

There are many kind of steel, for long runs production, a durable mould is required, the tool steel must be selected properly, for small volume production, steel selection can be as economic as possible as long as it meet the requirement of production demands.

How to choose the injection mould steel? Important steel properties include:

- Ease of machining
- Dimensional stability after heat treatment
- ► Wear resistance
- Surface finish
- Corrosion resistance

Factors to keep in mind

Quality: Quality is always at the top of the list. The last thing a tool shop needs is to have a steel problem while the mould is in production. Returning a mould for repair is not good for all parties involved. Repair costs in addition to production downtime are extremely costly.

Today's mills are committed to quality. Some have added high-speed forging presses to their process. These new presses have shown to improve the matrix of the steels that they offer to the market. An improved matrix means less chemical segregation as well as improved hardenability and less stress in the steel. These factors will help determine future costs down the road for tool shops and their customers.

With that being said, there is steel coming in from third-world countries that is not up to the high quality standards that tool shops are used to receiving. This reduced quality often leads to higher down-the-road costs in additional labor and subsequent machining for tool shops and their customers.

Fast Delivery: One of the ways that North American shops are combating foreign tooling coming into the country is with fast delivery. In order for tool shops to offer quick turnaround they are asking their steel suppliers to do more. Some steel suppliers are supplying their products squared to tight tolerances. This gives tool shops the ability to put the steel into their CNC machines and start on the cavity and core cutting right away. Other steel suppliers are also offering gun drilling as a method for cutting down on delivery times.

In the past year, the oil and gas industry has purchased large amounts of capacity from some of the mills, resulting in long leadtimes. In some cases 28 to 32 weeks. This trend is leaving tools shops without a quality steel source for their moulds. Some steel suppliers around the country are stocking larger blocks on their floor as way to maintain a viable source of material for these shops.

Price: We have all heard of the phrase "cheaper never means better." Everyone wants the best price they can get for their steel, and the mills have taken notice and are starting to respond to these pricing demands. Mills are now producing different types of steel to give tool shops a cost advantage.

Mould steel requirements

The mould has high requirements for steel. Whether the steel is properly selected has a great influence on the service life, processability and precision of the mould.





The requirements vary depending on the structure of the mould, the service life of the mould, the plastic used for moulding, and the performance, appearance, and dimensional accuracy of the moulded product.

A mould steel should possess qualities or attributes relevant to the intended application.

For general purpose moulding applications, the principal steel attributes are listed and explained below.

High core strength

As a result of the service conditions encountered during injection moulding, i.e. relatively high compressive cyclic loadings, the material core strength is of relevance to the mould designer.

The material must be able to withstand high compressive loads without cracking or splitting.

Good wear resistance

Mould tools are subject to considerable wear from many sources, which include:



- ► The polymer itself;
- The mould ejection system;
- The wearing action of shut-off faces;
- Abuse during cycling and shut shots.

Wear resistance may be imparted to a mould tool steel by various meansusually by hardening the material or the addition of property modifying alloying elements. The choice of which method depends on the material in question.

Wear resistance and abrasion resistance are the most important properties of mould steel, which have considerable influence on the post-processing of mould life, precision maintenance, overflow removal, etc.

Wear resistance varies according to the amount of alloy elements and the presence of internal stress.Wear resistance is generally proportional to hardness. Therefore, the hardness of the cavity surface increases, which can solve the problem of wear resistance.

Glass fibers are often added to increase the strength and wear resistance. In addition, metal fiber can also be added to the plastic to get conductive plastic to protect against radio wave interference.

Excellent surface finish

A good serviceable surface finish is of the utmost importance, especially for core and cavity components.

The intended material should be capable of sustaining a good long-term surface finish without the additional requirement of polishing between production runs.

As with wear resistance, the material's surface hardness and composition have the greatest influence on its finishing properties.

For the injection mould, the surface roughness of the mould cavity directly affects the surface of the product.

For transparent PC products, the surface of the cavity and core requires mirror polishing, and the polishability of the mould steel becomes a major problem.For mirror polishing of moulds, the following polishing techniques must be observed:

- 1. Polishing paste with high polishing ability
- 2. Uneven polishing power will produce an orange peel surface;

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In Focus

3. The abnormal layer of deterioration due to electrode processing and wire cutting can be completely removed by grinding.

Dimensional stability

The cyclic loading nature of the injection moulding process subjected to the mould materials to considerable levels of stress and elastic deformation.

The ideal mould material should possess sufficient strength and durability to resist permanent deformation but sufficient ductility to resist cracking and impact loadings.

For this purpose, many grades of mould steel, especially steel alloys, have been developed to fulfil the above requirements.

Machinability

The processing of injection mould components can be divided into machining (such as lathe, milling, numerical control milling, grinding, fitter, engraving, polishing, etc.), electrical processing (such as electrode, wire cutting, etc.) and casting processing. The selection of mould steel must consider both the service life and the machining of the die.

Consider the steel material from the machinability, it is best to use the low hardness steel that can be machined conventionally during cutting, but this steel is difficult to ensure the service life of the mould and the accuracy of the cavity.





Therefore, in actual work, the pre-hardened (quenched and tempered) steel with good machinability is often used as the mould insert.For precision and long-life moulds, nitriding treatment can be done on the surfaces of cores and cavities to improve the wear resistance.

Corrosion resistance

Halogen-containing plastic material such as polyvinyl chloride (PVC) and polyacetal often releases corrosive gases to damage the mould.In addition, beryllium copper is also a good corrosion resistant steel material.

In order to make the mould corrosion resistant, sometimes chrome plating is also done in the cavity, but hard chrome plating has the following disadvantages such as weaker corrosion resistance and the plating layer will have pinholes or cracks. Due to the local electrodes affect, it will lead to the corrosion of the steel and the plating layer, causing the peeling of the chrome layer.

Looking ahead

Many changes in the tool steel industry have taken place during the past few years which was result of growing demand from customers regarding productivity and life spam of the tool. There is no doubt that Powder Metal (PM) tool and highspeed steels have become a prominent product in the tooling market. In today's economy, factors such as complex geometry, work material and production efficiency have led to an increase in the use of PM grades for production in these demanding applications. These factors will continue to drive the market into the future. \approx

With inputs from www.plasticmoulds.net& www. moldmakingtechnology.com



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"With the onset of the Internet and opening of the Indian economy, our tooling industry has been able to evolve and grow continually and in the next few years we would be able to compete with the best in the world", says Pankaj Goel, Managing Director, Goel Steel in conversation with Nishant Kashyap. Mr. Goel is an alumnus of BITS, Pilani, and has over two decades of experience in the industry.

Q Please tell us about your company.

"Goel Steel Company is one of the key suppliers to the tool and die industry in the country. It is also an authorised distributor for over eight tool steel manufacturers across the globe. Our aim is to provide our users across the world with the best tool steels. We work very closely with Hitachi Metals (Japan), KIND & Co (Germany), SEAH (South Korea), Metal Ravne (Slovenia), and DEW (Germany) among others. They have all been constructive partners in our growth. In the last fivedecades, we have had the opportunity to study and work closely with all the tool steel manufactures of the world and see their facilities and manufacturing capabilities. Working closely with them has helped us find the best use of their products in our growing market,"

Q What can go wrong for the tool and die industry?

Every coin has two sides. Common sense is to keep looking at both. Our biggest fear will only come true if the growth story of our country witnesses a hurdle. While every investment has a cost attached, the purpose if met, then cost is nullified. Technology changes very fast. We are seeing a big demand for EV in future, dynamics of the Auto and Engg industry might change. Lot of our products might get redundant; we might no longer be needed. All these are fears. But it's a small price we pay for seeing the future generations excel. We need to keep a close tab and change and adapt quickly.

Q What is your advice to the tool steel suppliers? How can the future be improved ?

We steel suppliers are part of the service industry. Please understand that the base of any tool is the raw material and the heat treatment. Steel supply in the country is slowly moving from unorganised to organised sector. Tool steel is special and there are hardly any mills in India who are interested to manufacture these as they need lot of work and enormous research and volumes are quiet low. We as steel suppliers should yearn to make the experience complete for the buyers, like in most developed countries the steel supplier is responsible for the steel, roughing and heat treatment and the die maker can concentrate on the more critical aspect of die making and designing. 40% of any tooling costs is RM + roughing + Heat treatment. This can be a taken care by us. We have over many years put together more and more value added services and currently we are the only company who can offer the four services under one roof. It is not an easy job, with low margins and ever-increasing demands of customers, taking out funds to add these is not easy. Hence, we suggest tool makers plan it over a long period. Maybe every 3-5 years a new service can be added. I think the only way we can show to our customers we care, and we mean business is by working together with them and take some of their burden on ourselves.

Q You have been serving the Indian die mould industry for several years now. How has the industry evolved over the years? Have the demand patterns changed?

Goel Steel Company has been serving the tool and die industry for over five decades now. My father started this business in the 1960s when the engineering industry was taking its baby steps. The growth and prospects of this industry were negligible till the early 1990s, till then the import customs duty was formidable and the whole economy worked with lot of restrictions and closed doors. Only after Manmohan Singh as the Finance Minister opened the economy and Maruti Suzuki was

Leaders Speak

given permission to set up its plant in 1986, did the auto and engineering industry see some movement. Further, Hyundai set its plant in 1996 and therest is history. From what we used to discuss and what we are today, the tool and die steel market initially till the Early 2000 was a seller's market and now it has become a buyer's market. Demands have been increasing at the rate of 15% year on year since 2000. With the onset of Internet and opening of the Indian economy, our tooling industry has been able to evolve and grow continually and in next few years we would be able to compete with the best in the world. Demands are growing year on year and the requirement for more specific steels for specific applications will keep growing. When we see where we stand in terms of actual consumption of tool steels in countries like Japan or China, we still have a long way to go. We feel we need to grow more 700% to be able to come to standards of Japan or Germany.

Q Tell us about the current trend in the Indian die mould and tool room industry?

Tool and mould industry can be classified broadly into cutting tools/plastic moulds/press tools/ PDC/forging dies/extrusion industries. We might be totally wrong, but from where we see it, other than cutting tools, all other industries will grow continuously in India. Press tools are already at a good level and most of the dies are already made here. So is the case for forging and extrusion industry. But plastic mould and PDC industry still has a lot of growth ahead as still over 40-50% of these are imported. Even the biggest dies of PDC that we make are quite small when compared to the dies that are imported. Currently, we are all struggling to compete and survive on the basic die making levels. What we feel is that our industry operates at very thin margins and the need to be cost competitive robs them the chance to grow and invest in new technology. Unless we all make a conscious decision to give healthy working margins to our tool and mould industry, we fear it will collapse under its own burden of fighting for survival. Tool and mould industry is more like an art industry, it works best when the atmosphere and amenities are conducive. Under pressure tool makers might not be able to invest in new technologies and gear up for world competition.

Q What are the new materials/grades used in tooling industry?

If we compare what was available 20years ago, today the choices of steel and the various specifications based on application are enormous. The 'one size fits all' concept is dead, and the industry is at a luxury to choose from many options available to them. Tool steels are continuously being researched and developed to suit the ever increasing tooling demands. I will give you an example, India defence industry has close collaboration with the USSR (atleast in the past) and even today all their drawings follow the GOST specification. No one wants to work and change them to more relevant and easily available steel grades. Most defence cutting tools follow the T (Tungsten) series in the drawings for last 50years, although the rest of the world has shifted all cutting tools to M series (Moly based). Now, the M series is so much cheaper than the T series, and also do you know the density of T is more than Mo etc, and hence the weight is also more. Now you might ask me how is this relevant? Well it is just an example. We all need to keep our eyes and ears open. New steels, new grades, new manufacturers are always evolving, just be ready to experiment. As engineers, we are all tuned by default to try new things, fear of failures should not stop us from exploring new avenues.

Q According to you, what are the Indian mould makers looking for with regards to materials?

This is a very interesting question. Honestly, I do not think most of them know what they are really looking for. I feel there is a huge gap between what they really need and what they really use. It might also be a result of the tight budget that we all work in. It is very important that the end user/tool maker and the steel supplier work closely to provide what is really needed. The demand always starts with the best property based on application, and as always, a superior material will not always be the most competitive product, and in the end a compromise is reached. We have been in this industry for over 50 years, and our portfolio currently boasts of the many of the world's best manufacturers whose products we stock and distribute. In the past we were distributors for few more too, and what we would like to explain is that the brand of steel is built over a long period of time and lot of hardwork and consistent performance results in a strong brand. Also, what goes into brand building is a strong marketing campaign of the mill. We have visited almost all tool steel manufactures facilities in Europe/Asia, and trust us, all of them are equally good. At theend of the day, we would suggest that the mould maker chooses a supplier closest to him logistically and someone who can work closely with them for various steel grades. We would not say that only specific manufacturers are the best. If a mill is making tool steels, mostly they are all over 100 years old or are equipped with the latest technologies. You will be in safe hands.

As a supplier to the tooling industry, what would be your suggestion to the Indian mould makers? In continuation of my previous views, do not be scared to try new products or grades. For people who have been following the steel production of the world, Sheffield in UK used to be among the first places where steel was made, now it is non-existent for steel atleast. East Europe is still making steel, but the marketing abilities are limited and hence the more stronger European counterparts (Germany/Sweden/Austria etc) buy and market those steels. In the 1970's, Japanese steels were considered the cheapest and low quality, today they are the most expensive and high quality.Today, Chinese steels are where Japan was. So, the dynamics are always changing. What is today might not be the same tomorrow. We suggest make a conscious decision, interact with the supplier, pass a chunk of responsibility of steel quality to the supplier.

Q Tips to select right material grades for a particular operation...

Tool steel is all a combination of alloys and heat treatment and working temperatures and applications.We the steel dealers are very well equipped to suggest the right material for the users' application. First and foremost, what we request users is to believe that most of us in this trade are gualified for this. And in case we lack the knowledge of some specific applications, we will always have the experts from the mill who can give recommendations and suggestions. I am in this chair for last 25 years, but I am not a qualified metallurgist, but we have been only living and sleeping this tool steel since. We feel our knowledge would be as good or even better than someone who just holds a metallurgist degree. They just teach twoyears specifically for your degree related subjects in an engg college, I think the user needs to trust our values on this. Today information is available at finger tips. Every manufacturers catalogue has all the information of possible grades, applications.Machining parameters are listed,heat treatment properties are listed. I would say, keep it simple, please tell us the application and the properties needed, and we will take care of the rest.

Q What are the factors that might change demand for Indian die mould suppliers?

Our 1.3 billion population that people used to consider challenging is, in my opinion, a great opportunity. We have the world's largest young population who are creating huge domestic demands. The domestic demand, in practically all the industries, is so high that we don't have to think of exports. We can 'Make in India, for India' ie we can do excellent business within India while catering to the soaring domestic demand. Government focus on infrastructure will provide a boost to the auto and engineering industry. Let me share some views that might help us grow further:

- Increase purchasing power of common man. For that increase the minimum wages.
- Decreasing the difference between blue collared and whitecollared jobs in terms of perks. Today we have engineers in abundance, but no one is willing to work on machines. Why?
- Encourage tier 2/3/4 cities to grow. Connect them with all the necessary infrastructure. All growth is focussed on a handful of cities and the rest of the country is underdeveloped. This also puts a lotof pressure on these cities and they are collapsing.
- Currently most of our tool and die makers do not concentrate on export or I would say we still need to improve a lot on our facilities to be able to meet the export demands. Globally even the biggest plastic mould steel users for automobile tools choseto make 'B' category parts only in India and not the main ones.We need to rise to 'A' category soon. This can happen only by improving our quality systems by increasing investments in new technology and R&D.
- Q How do you see the emergence of additive manufacturing technology? Do you think it will impact the material supplier's business?

Every new invention or technology has the potential to wipe out the old one if it is better and more competitive. Look at what happened to tapes, cassettes, CD, music systems, cameras, fax, landlines etc.Currently Additive Manufacturing is expensive, but the day it becomes affordable for mass production, we all need to find new businesses.

These are still early days,but the technology looks promising and for sure has lot of advantages for prototypes and custom-made products for sure.

- **How can Indian mould makers be more competitive?** Explore. Watch. Learn. Innovate. Adapt. The rules are already written. Someone is already doing it successfully in some part of the world. We are way behind.Currently, the fastest way is to learn from them and adapt it into our society. Ofcourse they say, 'Nakal ke liye bhi akal chahiye hothi hai', so just don't replicate, make it or tune it to our conditions.
- **Q** How do you see the future of Indian die mould industry?

Sky is the limit. Of course there is scope for improvement. We expect the industry to grow at 15% per annum and reach its saturation in 15years from now. And 15 years for a country is not very far. We need to buckle our shoes for the sprint. \approx

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"Indian Tooling Industry is on Growth Trajectory"

"One clear trend emerging now is that the amount of imports of die and moulds is reducing whereas the domestic demand is rising. On average, the die and mould components market has been growing at an average CAGR of 15-16% in the recent decade," says Mr Pulkit Datta, Head of Sales and Marketing - Tool Steel Products, Hitachi Metals India in conversation with Nishant Kashyap.

Q You have been serving the Indian die mould industry for the last three decades. How has the industry evolved over the years? Have the demand patterns changed?

We are fortunate to be among the first tool steel manufacturer from Japan to have set foot in the Indian market and be a part of the evolution process. The most prominent change over the last decades has been the proliferation of local capabilities as compared to the era when die &mould was restricted to imports from Japan, Taiwan, and South Korea. This evolved to a phase where it was available for captive tool rooms, but now it's available for the commercial tool rooms.

The introduction of CNC machines, latest CAD-CAM, and simulation software combined with the everincreasing skilled manpower has enabled the giant leap in domestic capabilities.

From a demand, perspective-there is a renewed emphasis on assigning importance to the lightweight of interior and exterior trims and therefore increased usage of high tensile steels and plastic injection moulding in automotive interior and exterior.

Q Tell us about the current trend in the Indian die mould and tool room industry?

One clear trend emerging now is that the amount of imports of die and moulds is reducing whereas the domestic demand is rising. This incidentally has coincided with Make in India initiative and push from the Government. On average, the die and mould components market has been growing at an average CAGR of 15-16% in the recent decade. Machines with latest features are being used, not only with the latest CAD/CAM but simulation software as well. Even the size of tools and the capacity itself is seeing an uprise. For example, it took 26 years for machine tonnage in the die casting segment to increase from 800T in 1974 to 1400T in 2000. On the other side, it took only 10 years to increase from 1400T to 3200T. Similarly, the trend for the press tools is focussing more on high tensile light metal components.

Some relevant trends in the various departments relate to high-speed machining as well as multi-axis spindles machining centres to produce complex dies in single set up, usage of latest simulation software for flow, solidification and Finite Element Analysis (FEA).

Lastly, automation continues to find inroads into the tool and die segment. Indian tool makers are making complex moulds and dies from digital designs. Overall planning is a major challenge in tooling industry for even experienced human workers, but it has been well taken care by the latest automation technologies. So automation is definitely finding a big foothold in the Indian tooling industry.

Q What are the new materials/grades used in the tooling industry?

Innovation and advancements in technology are perpetual exercises. We are also investing a substantial amount on research and development to come up with new grades/ compositions to make our customers even more productive and competitive. As far as trends in the industry are concerned, there is a clear shift towards more refined grades, with lesser impurities. Processes like vacuum arc remelting are now employed more to produce cleaner grades. Also, tool steel manufacturers are investing a huge sum in forging capabilites so that the steel produced is cleanest with higher uniform microstructure. The pursuit of high abrasion resistance, excellent lubricity and heat resistance requirements of various dies and forming tools, is making hybrid PVD technologies necessary with laminated functional layers. This process realises higher film adhesion by the most suitable pre-treatment and cleaning.

According to you, what are the Indian mould makers looking for with regards to materials? In my opinion, Indian mould makers are essentially looking at:

- ► Leadtime: The criticality cannot be overstated. Material is required once the design process is already completed and the production deadlines have begun. Delay in the availability of the material can jeopardise the entire project.
- ► High Performance: Latest grades that can enhance the performance, be it high polishability or enhanced tool life to reduce the downtime for tool change.
- Near Net Shape: Mould makers' expertise lies in producing moulds and not machining. There is an increasing expectation for finish sizes, minimum excess material to the point that even the rough scooping of the cavity is being expected at the material supplier stage itself.
- Heat Treatment reliability: Heat Treatment (HT) is an integral link in the process of getting the maximum output from the material. Mould makers look for exact recommendations in terms of the HT process.
- Machinability: Ease in machining to improve productivity as well as reduce production costs.
- Q As a supplier to the tooling industry, what would be your suggestion to the Indian mould makers? We have the earnest belief that our success is deeply interlinked with the success of our users. Hitachi Metals' expertise lies in providing high-quality solutions produced in our mill in Japan, enshrined in the traditional Tatara steel manufacturing process. We would suggest:
- Imploring the users to discuss the application clearly to raw material suppliers for choosing the most optimised grades.
- ► Not compromising on the long term saving in production costs and elimination of downtime by investing in good quality steel.

- Making sure the heat treatment recommendations are adhered to the performance of specific grades of tool steel.
- **Q** Tips to select right material grades for an operation ...

Any tool steel grade consists of a unique composition of alloying elements. For a user, it's important to discuss the application thoroughly with the material suppliers. But it's always good to have the basic knowledge regarding metallurgy as well as the impact of individual alloying elements on the various aspects of production - be it hardenability, machinability, strength or toughness.Broad criteria's are whether the tool is going to be used in high impact applications,or working under high temperature& speeds,low temperatures or plastic moulding.The makeup of tool steels varies significantly in hardness, wear resistance and toughness.

It's also important to have a track of the existing failure mode of the tool. A failed tool can provide a lot of information on the selection of an improved grade. A layman's explanation is that worn out tools need tool steel with higher wear resistance whereas a tool with cracking chipping or other catastrophic failure would need a tougher grade of tool steel. Tools which have simply deformed under pressure, probably need higher hardness.

Another important factor is criteria of cost. Compromising on the choice of material may not result in lower overall production cost if the tool proves to be inferior and fails prematurely. A costbenefit analysis should be undertaken to ensure that the tool steel material chosen will provide the performance required.Our application engineers work closely with the customers in analysing the application and the demand before coming up optimised steel grades.

Q How do you see the emergence of additive manufacturing technology? Do you think it will impact the material supplier's business?

India's 3D printing market is growing at a rate of 20% and is expected to register US\$ 79 million by 2021. Automotive (21.2%) and electronics (24.1%) hold the highest share in the Indian 3D printing market, while healthcare, aerospace, and defence sectors are witnessing significant growth too. Hitachi Metal Corporate Research Lab, Global Research and Innovative Technology (GRIT) in Japan are continuously working for innovations in metal

3D printing and has developed various materials depending on the applications. Even in the traditional tooling set-up, we see some applications for conformal cooling channels in dies.

3D AM is a tool used for rapid prototyping, although it would not impact the material supplier's business but will complement it. In the die and mould industry, where the strength, finishing, and life of die are prominent features, it would not be easy for 3D AM to exactly replicate the application .However many enhancements can be seen in producing samples at a quicker pace as well as producing intricate fixtures for example.Traditional and additive manufacturing shall go hand in hand in the future.

Q How can Indian mould makers be more competitive? Optimisation is a continuous process. We firmly believe that there is always scope for improvement no matter how refined a process is. Implementation of lean manufacturing processes like VSM, SMED, 5S is the need of the hour for the manufacturers to be more competitive. Most importantly, continuous investments in skill development which can be training facilities. in-house done through collaboration with technical institutes as well as the partners in the eco-system, including material suppliers. Since tooling is a capital-intensive industry, any advancement in technology may require a substantial financial investment. This is where a comprehensive support policy from the government can play a pivotal role in ensuring the SMEs are able to not only sustain but thrive. 😞

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Leaders Speak



"Indian tooling suppliers can look forward to positive days ahead"

Fumio Takayanagi, Managing Director (Exports), DIJET Industrial Co. Ltd.

Q What are the various challenges in the industry?

I believe major challenges faced by this industry is manpower, lack of finances and Government policies like high import duty on Machine Tools and Cutting Tools. As die mould and machine tools are the pillar industry for manufacturing sector, Government should have special focus to uplift this industry. If we have strong die mould and machine tool industry in the country, we certainly will have a world class manufacturing output in the country. Also, the government should encourage new and young entrepreneurs by providing them easy finances options for capital investments. Tooling sector is very capital intensive industry, if we have to encourage more people to join the industry, we must as a nation support them with finance and skill development.

Q Your suggestions to Indian tooling suppliers

As a cutting tool suppliers to die mould industry, I would say your upmost focus should be in technology. Now the world is looking at us, OEMs are ready to source tools from India and we are having steady growth, our response should be impactful. We cannot, anymore, overlook the technology. We must upgrade our self and adopt to the latest happenings around the world. There is no doubt, we have capabilities and skills...however we still needs a long way to go.

Q How do you see the future of Indian tooling industry?

Even though the economy and the automotive industry which is the biggest consumer of die mould and machine tools were not in good shape, I am still bullish about the Indian market. However, the situation has changed because of COVID-19 virus and global economy is hit. It may take sometime for economies around the world to bounce back because the impact is global and almost all major manufacturing countries are in standstill. Having said that, I expect once the virus contamination is controlled we will witness a huge growth. I believe Indian tooling suppliers can look forward to positive days ahead. All the consumer industry, including automotive is expected to witness a healthy growth rate in India. *«*

Your views about the Indian die mould industry? The Indian Die and Mould Industry is growing rapidly, thanks to the growing demand from the OEMs. End users are trying to source more and more tools from the domestic suppliers which is a good shine as it not only helps in getting better business opportunities but also to enhance the productivity and capabilities. Companies in India, I see, are now ready to adopt technologies. There is always a limitation for good machines and good dedicated manpower, and also the input cost is a big limitation. However, things are changing gradually and we can expect a good days ahead.

This industry is growing in India basically because of the demand from automotive, packaging, electronics appliances, home appliances, among others. In coming days, this demand is expected to grow even further and further propel the need for more and more Die and moulds. Currently the demand is higher than supply in India, which is one of the reason for high imports of tooling in the country.

Q What are the top trends you observe in the industry?

As the Indian Die and Mould industry is getting matured and having a constant double digit growth every year, manufacturing of complex mould is getting easier for the tool suppliers in India. Currently, all automotive manufacturers are trying to reduce the weight of the vehicle by using plastic parts. For example, weight of Maruti SWIFT car produced by Maruti Suzuki Pvt Ltd is reduced almost by 300 Kgs. Also, electric cars are growing and it will also have huge amount of plastic parts in the cars, so the demand will definitely increase. In my opinion, tool suppliers will have to closely watch these automotive changes and align their strategies accordingly.

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Tech Focus

Premium Tool Steels – The Key to High Class Die Casting

ie cast components have become a companion in our daily life. Household articles, cases for electronic instruments or structural components of cars and two wheelers are produced in large quantities by highpressure die casting (HPDC). Complex shapes, higher surface requirements, and increasing economic pressure to reduce production costs are actually permanent challenges to the die casting industry.

The lifetime of die casting dies depends on many aspects. Carefully selected tool steels and properly heat-treated dies are certainly among the most important factors.

This paper introduces modern premium hot-work tool steels from Kind&Co, a leading German tool steel producer. Properties will be described and recommendations for optimal tool steel selection will be given

1. Loads on HPDC dies during the casting process

During the casting process HPDC dies are exposed to complex loads consisting of chemical, mechanical, cyclic and thermal components. Chemical load results mainly from interactions between cast aluminium alloy and die steel. The ability of aluminium to solve iron can result in wash outs of contours. Increasing process temperature or low Fe-concentrations of the cast alloy intensify this chemical reaction which is also responsible for sticking of the castings on the die surface. The mechanical loads result from the abrupt injection pressure, the closing force of the casting machine, and from ejecting forces. The cyclic contact with the liquid cast alloy, followed by spray cooling, leads to cyclic expansion and contraction of the die steel in the surface area which finally results in thermal fatigue of the die steel and the formation of heat checking cracks with their characteristic net-like appearance.

Based on the analysis of the loads the most important properties of hot-work tool steels for HPDC dies are:

- High strength and fatigue strength at elevated temperatures,
- Sufficient tempering resistance,
- High toughness potential, and
- >> Sufficient thermal conductivity.

Whenever hot-work tool steel is to be selected for a HPDC die, the specific loads, the size, and geometry of the die as well as other relevant aspects like melt temperature should be considered individually.

2. Hot-work tool steels for HPDC dies

- Offering the entire range of hot-work tool steels for die casting dies Kind&Co distinguishes between "good standard grades" and "premium grades".
- Good standard: The alloy compositions of USN ESR and USD ESR correspond to the internationally standardised grades 1.2343 (AISI H11) and 1.2344 (AISI H13) /1/. They can be regarded as good standard grades (Figure 1) for many applications. Due to the individual production processes at Kind&Co they, however, provide an excellent performance.
- Premium: HP1, TQ1, and CS1 are premium grades specifically developed by Kind&Co. Based on the principle of highest cleanliness their concentrations of P and S and also of detrimental

trace elements like AI, Cu, and Zn have been drastically reduced. These three grades had been developed for dies with large volume and challenging design.

With respect to the high demands concerning homogeneity and toughness Kind&Co produces these grades for HPDC dies exclusively via the Electro-Slag-Remelting (ESR) technology.

Based on the most important material properties for HPDC dies – thermal shock resistance and toughness – Kind&Co classifies these five grades into "good standard" and "premium" grades (Figure 1).



Figure 1: Classification of hot-work tool steels for HPDC dies as standard and premium grades

In addition to these two important properties it is important to avoid softening of the dies during the casting process. The resistance against softening is described by the tempering resistance of the selected hot-work tool steel. Tempering curves of the steels (Figure 2) help to select the best suitable grade with respect to the thermal household of the dies. They are also an important tool for the heat treatment of the dies.

The five steel grades listed in table 1 are characterised by a definite secondary hardness maximum between 525 and 550 °C tempering temperature. The curves indicate an improvement of tempering resistance in the sequence USN ESR => USD ESR => HP1 => TQ1 => CS1.

It was one of the basic ideas in the development of grade CS1 to provide a very high secondary hardness

maximum in combination with high tempering resistance. The tempering curves in Figure 2 display clearly that CS1 develops not only the highest secondary maximum but also the highest resistance against tempering. This way it offers best possible resistance against undesired softening during casting operation.



Figure 2: Tempering curves of hot-work tool steels for HPDC dies

Good high-temperature strength is an important property of die steels in order to withstand the thermal loads during the HPDC process. As the contact zone between liquid alloy and die is exposed to the highest temperatures a temperature range of 300 - 550 °C should be considered as working temperature. This range is therefore highlighted in Figure 3 which displays the values of the yield strength Rp0,2 for the discussed tool steel grades.



Figure 3: High-temperature strength of hot-work tool steels

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The premium grade CS1 has been designed to provide further increased high-temperature strength in combination with excellent toughness. The potential of a significantly higher secondary hardness maximum (58 HRC) can be used in order to set up the working hardness of CS1 in HPDC dies up to 56 HRC. The effect of increased hardness on the hightemperature strength can be seen in Figure 4.

In addition to good high-temperature strength hot-work tool steels for HPDC dies need to have sufficient toughness in order to withstand the sudden mechanical and thermal loads of the HPDC process. Figure 5 displays typical impact energy values measured on ISO-V-notch samples. Compared to USD ESR (H13 ESR), the most frequently used grade for HPDC dies in India, Figure 5 underlines the increased toughness potentials of premium grades like TQ1, HP1, or CS1.

The selection of suitable hot-work tool steel for HPDC dies should be based on a detailed analysis of the specific loads as well as size and geometry of the dies.







Figure 5: Impact toughness of hot-work tool steels for HPDC dies

(ISO-V-notch samples, transverse orientation, core of ø 320mm, 45 HRC)

3. Tool Steel Selection - Examples

The decision for a hot-work tool steel for a HPDC die should be based on specific requirements of the cast product, geometric aspects of the die, and the scheduled number of castings per die.

In the process of steel selection, it can be distinguished between standard die cast components, e.g. automotive gear boxes and other powertrain components, and premium products with very high surface requirements.

Dies for standard products require hot-work tool steels with a well-balanced combination of high-temperature strength, toughness, and heat checking resistance. For these products Kind&Co recommends USN ESR and USD ESR.

USN ESR is the most frequently used hot-work tool steel for aluminium die casting in Europe. It combines a sufficient high-temperature strength, tempering resistance, and heat checking resistance. Traditionally, American and also Indian die casters prefer the grade USD ESR which, due to its higher Vanadium-content provides increased high-temperature strength and tempering resistance. The resistance of USD ESR against heat checking cracks is higher than of USN ESR. On the other hand, compared to USN ESR, its toughness is lower.

Products with visible or aesthetic surfaces can often be regarded as challenges for the caster. For those high surface requirements dies must have a high resistance against thermal shocks. These cracks with their typical network appearance are not only transferred onto the casting but they also propagate into the steel and limit tool life.

As thermal shock cracks are generated mainly by the external spray cooling process their formation cannot be avoided completely but the selection of suitable tool steels, a carefully defined hardness, and a proper heat treatment can delay formation and propagation of thermal shock cracks.

Within certain limits increased hardness can improve the thermal shock resistance of the steels. Increasing hardness goes along with rising fatigue strength but it also reduces the toughness with the negative effect of a simultaneously higher risk of gross cracking or cracks in small radii of the die inserts.





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Tech Focus

The influence of the hardness on the toughness of hot-work tool steels is demonstrated in Figure 6



Figure 6: Influence of hardness on toughness of hot-work tool steels.

The typical hardness range of standard HPDC dies of USN ESR or USD ESR is 44 – 46 HRC. Dies of USN ESR should usually not exceed 47 HRC, dies of USD ESR should have a maximum hardness of 46 HRC. Higher hardness values should be discussed with the steel supplier. Due to their significantly higher toughness level dies of HP1 and TQ1 can be used up to 48 HRC, CS can be even used up to 54 HRC.

Selecting a premium tool steel with improved profiles of properties, especially improved high-temperature strength in combination with higher toughness, is a safer way to produce premium products.

HP1 offers a significantly improved thermal shock resistance which leads to improved quality of the castings and to significantly improved die life. Figure 7 compares castings from a double-insert die with one insert of a 1.2343-type steel and one made of HP1. The quality criterion for this automotive product was that traces of cracks were not tolerated on the castings. The comparison of castings after 80.000 shots demonstrates clearly visible crack marks on the casting from the 1.2343-insert. The adequate product from the HP1-insert was still completely free of these traces. The use of HP1 not only resulted in a better product quality but also in a significantly improved die life.



Figure 7: Comparison of castings from a die insert of 1.2343 (H11)-type (left) and of HP1 (right). Traces of cracks on the castings (bottom). Condition after 80.000 shots

The premium grade CS1 provides a combination of outstanding working hardness and toughness. This combination of properties is very beneficial to delay growth and propagation of thermal fatigue cracks. Therefore, CS1 is recommended for HPDC dies for highest surface requirements.

In India the production of two-wheelers is a very important branch with high production numbers. Modern motorcycles have numerous die cast components, many of them have to fulfil highest surface demands – for technical or aesthetic reasons (Figure 8). For those products CS1 could improve lifetime of the dies by up to 300 %. Other cast components with highest demands for accuracy and surface quality are cases for laptop computers, mobile phones or other electronic devices. CS1 has delivered excellent results here as well.







5 HORRIBLE MISTAKES

PEOPLE MAKE WHILE CHOOSING A HEAT TREATMENT PARTNER MISTAKE 1 WISTAKE 2 NOT VISITING The facilities of heat treatment company (seeing is believing) MISTAKE 3

MISTAKE 3 NOT TECHNICALLY Auditing the heat treatment process as per relevant standards

MISTAKE 4 NOT RELIEVING Component application information

MISTAKE 5 TRANSACTIONAL

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Figure 8: Die cast motorcycle components with highest surface requirements

4. Availability in India

Together with Goel Steel Company in Chennai as exclusive agent and stockist Kind&Co has been supplying tool steel to the important Indian market since 2008. Goel Steel Company provides a wide network of services including stocking, machining, vacuum heat treatment, and surface treatment. Because of the long and trustful collaboration and the exclusivity between Goel Steel und Kind&Co, we jointly supply the Indian market with high quality solutions for die casting, superior service, and qualified technical support.

Conclusion

High pressure die casting is a modern and effective production technology for metallic components in large quantities. Ongoing development of new cast products, increasing demands on their quality and growing economic pressure require reliably performing dies.

While standard products can be cast successfully in dies of USN ESR and USD ESR, products with visual

and aesthetic surfaces require hot-work tool steels with properties well-adjusted to the increased loads on the dies. Special hot-work tool steels like TQ1 and HP1 provide excellent high-temperature strength and toughness and offer potential to increase the lifetime significantly.

The fast-growing market of two-wheeler production offers many challenges for premium cast products with highly aesthetic surfaces. The newly developed steel CS1 offers a unique combination of excellent high-temperature strength and toughness. It has proved its suitability for products with highest surface requirements successfully by increasing the die life by up to 300 %. ~

References

/1/ International Standard ISO 4957:2018: Tool Steels.

About Author



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Technology Partners Profit from Innovative Tooling Concepts

ogether with its technology partners, Feintool is engaged in the ongoing development of innovative tooling concepts to enhance product quality and gain a new competitive edge. This article describes two trendsetting manufacturing methods for gearbox parts. The first process examined is for producing a well-known working part in the clutch packs of automatic transmissions, while the second example concerns the first operation in the manufacture of synchromesh clutch bodies for manual gearboxes. Both cases involve patented processes using sophisticated fineblanking tooling.

Patented deburring process for clutch plates in fineblanking tooling

The manufacture of clutch plates for clutch packs in automobile automatic transmissions is rapidly becoming more important. Gearbox manufacturers are increasingly turning away from splined plates manufactured by conventional stamping. The increased contact area between clutch plates and drum offers major benefits in terms of transmission service life and sustainable gear-change quality.

In addition to the specified close tolerances and fineblanked surface quality, the features that characterize a good quality clutch plate are its flatness and a structured surface. This surface roughness is defined within narrow limits and is crucial for its wear properties and a flat torgue curve when the transmission is engaged. A sophisticated development in the cold rolling process has today replaced the use of belt grinding to finish the surface. At the same time an intensive search was launched to find a blanking process that would eliminate the need to deburr the workpieces coming off the press. Tool Engineering at Feintool Lyss has cooperated with a leading German gearbox manufacturer to develop just such a process, which has been patented worldwide.







Following this breakthrough, we have also carried out several further development stages that have raised the productivity of the entire manufacturing process so significantly that it now represents an undisputed industry landmark. Two components, optimally nested in the strip stock, are produced at every stroke of the press. Today, carefully designed integrated production units manufacture over 3800 readyto-fit clutch plates per hour, which are supplied directly to the assembly line. All the additional operations formerly necessary, such as workpiece preparation on tandem systems, deburring, surface finishing and even the 100 % visual incoming materials inspection have been completely eliminated. These clutch plates, predominantly with external splines, are manufactured in stock thicknesses ranging from 1.1 to 6 mm in the steel grades C15 / St4K40 / ZStE380 / AISI 1020 / SAPH45. The two-cavity tooling is installed in fineblanking units of the latest generation with total press forces of 7000 or 8800 kN. Dramatic cost savings ranging from 20 to 50 % compared with clutch plates that need belt grinding and/or barrel finishing are achieved. In terms of tool engineering, Feintool has created an exceptional benchmark.

Patented fineblanking of clutch bodies with tapered teeth

Synchronizer units are incorporated in automobile manual gearboxes to ensure that changing gear is smooth and silent. A key component in these units is the clutch body, a ring with a toothed circumference formed from sheet stock 4 to 6 mm thick. The clutch bodies are fitted onto their respective gears and welded to them. This assembly complies with the most exacting requirements for silent operation and power density. A special feature of the clutch bodies is their tooth geometry. The faces and flanks of the involute teeth are not parallel but have a 4° taper at both sides. In addition there is a 90° rounded chamfer on the leading edges of the teeth. Very

Case Study



close tolerances are specified for the profiles of the tapered teeth, and there are exacting requirements for component flatness.

Although the rounded chamfer is today still mainly produced afterwards tooth by tooth on special swaging machines, the most accurate and costeffective method for the taper is to cut it directly in the fineblanking process. A Feintool customer patented this process several years ago and Feintool has the privilege of being a joint user. The fineblanking tool sets used for this are of the highest precision, and a wealth of experience went into the manufacture of their die cutting elements. Recently Lyss for the first time also supplied two progressive compound tool sets which combine the patented cutting technique with a 4-stage drawing and sizing process for a high precision necked-out collar. This component is manufactured in DIN grade 16MnCr5 stainless steel. The long drawing stroke necessitates a correspondingly long return stroke of the moving die plate (25 mm) in the tooling, thus reducing the maximum achievable number of strokes to about 20 per minute. Both tool sets are installed on a new HFA 7000plus fineblanking system for the series manufacture of components for a German luxuryclass automobile gearbox.





Summing up

The Feintool Technology Centre in Lyss has worked in close cooperation with its technology partners for many years – as have the Technology Centres in Cincinnati and Atsugi also – to create innovative new or improved solutions and maintain the technical and commercial competitive edge in the mass production of a wide variety of components based on the fineblanking/ forming process. Not only does this result in winwin situations for both partners, but it also produces international patents and – last but not least – crucial purchasing benefits for the final customers. \approx

Courtesy: Feintool Technologie AG



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Tips & Tricks

Lock Down:

Things to Care for in Tool / Mould Shops!

Locked down for 21 days and how to come back to work with most of things in the same condition as you left them. Read on to revise most of the things you already know and would have implemented.

Some things tool shops need to take care while we are closed.

- 1. Apply anti corrosive to all mold plates and cavities, especially those that have already been nicely polished and have deep ribs. You do not want too much mess and waste of time when you resume.
- 2. Cover all open molds, as pigeons and other birds will be looking over your tool shop while you are away.
- 3. Apply anti corrosive to all machine beds and drill machine columns. EDM beds included. Clean up all types of fallen coolant and tool chips from the bed.



- CNC Milling machine spindle should not be empty and there should be tool in it to avoid spindle taper from rust.
- 5. CNC Milling machines bed axis to be placed at extreme corners (little away from home position)
- 6. Z axis should be at possible downward position for the milling heads.
- Turn off the pneumatic air connection to the machine (don't just switch the compressors off, turn down the valves for respective machines too)
- 8. Turn off the machines as per its process. Be calm.
- You may be having may tool holders and shrink fits in your tool crib – make sure to have them protected from condensation and corrosion – apply anti corrosives.



- 10. Coolants from the tanks can stink badly if left unmoved and render them unusable later. Check if your coolant is having anti-fungal solution from the manufacturer itself.
- 11. Compressors may need to be started every couple of days, train you onsite security staff if they can do it even if only for few minutes. Check if your DG also needs similar help to keep it running fine once you are back.
- 12. All power should be off from Mains panel and all small switches turned off. If you have, a pantry and refrigerator empty it of all foodstuff and turn it off.
- 13. Compressed Air from all outlets to be released if possible. Moisture may cause corrosion at the joints. Also why leave the pipes pressurized..
- 14. Spotting press platens are better if supported while in closed condition. Keep a mold or supports and just let the platens rest there.
- 15. Remove blue from all molds if they were in middle of spotting, blue may contain water and it would be difficult to clean up after 21 days.
- 16. Unplug your polishing equipment. Check that all bottles with flammable liquids are emptied or closed properly.
- 17. Unload molds from molding machines if they were in the middle of trials. Heavy molds and inertia may cause damage to the tie bar bushes.
- 18. Apply anti corrosive to molding platens and magnetic beds.
- 19. Shut down process for molding machines is very important. Non cooperative Material left out in barrels can be bad. Purge if possible. Turn off mains and water supply. Clean all molds of water in cooling channels.
- 20. Remove all load from weighing scales.
- 21. If there are battery operated instruments or equipment you can consider removing the batteries.
- 22. Pest control and rodent catch can be provided if you do not want the nuisance to play havoc while you are away.



- 23. Keep out all your indoor plants and have a plan to have them watered, you will need them to cheer you up when you are back.
- 24. Provide for sanitizers and masks for your onsite security and staff. Food provision need not be told...
- 25. If you have any pets on your factory premises keep them in mind too.
- 26. Seal all factory and office buildings to prevent from theft. Industrial areas tend to be more vulnerable due to less people around. Make sure your CCTV is working on your cell phones too.
- 27. Call your plant once a day to keep staff staying there in good spirits and know if they need help.

Tool room operations are very much human skill dependent. It would be vital to avoid unnecessary clean up mess and other losses when operations resume and be ready to start working and cover up for the lost time right from the word Go! Follow these practices and keep your tool room healthy.

Take Care, Stay Safe!

Be Patient - Being restless souls this is going to be a real test! ≈

About Author: Kripal S Bedi,



Head of Design at Sridevi Tool Engineers carries Automotive Tooling Design and Manufacturing expertise. Mr Bedi has about 25 years of hands on experience in the industry, handling various positions and

verticals across the Plastic Product development Life cycle.

Tips & Tricks

Preventive measures for shut down CNC machines for long time

The spread of coronavirus pandemic is worrying everyone globally. The increasing number of cases has resulted in lockdowns. While we all are trying to get used to this new life, the machines are lying idle in shop floors. Here are 8 tips to keep your machines healthy during the lockdown period:



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