WELDWELL Spectrum

Quarterly Newsletter of Weldwell Speciality Pvt Ltd

Vol. 27 No. 1&2 Jan to June 2020

Mr C C Girotra, MD – Weldwell being honoured with Jaeger Memorial Lecture Award at IC - 2020

HIGHLIGHTS

WELDWELL®

IN SERVICE TO THE WELDING COMMUNITY

Editorial

It was a very eventful start of the New Year 2020 for the welding fraternity. The Indian Institute of Welding Mumbai branch organised the 5th. International Welding Congress IC-2020 along with Weld India 2020 trade fair, held from February 6th. to 10th February and is the focus of this issue. This was followed by "Boilers India 2020", an exhibition of all representing the power industry, and held in end February 2020. Both the events are covered in this issue,

However, immediately afterwards, the entire country and world was enveloped with the pandemic COVID –19, spreading a pall of gloom. Measures such as, lockdowns had to be resorted to, that put a halt to all activities. It is hoped that these pro-active initiatives will see us through this calamity. Now, as, the country begins to open up following nearly three months of inactivity with new norms with safety for operations to start. The next few months all industries will face difficult times and companies would need to re-establish efficient supply chain flows. One and all will have to brace themselves to revive the economy at large.

In view of these circumstances, the present issue is a Combi of Volumes # 271 and 272 is being released online on our website www.weldwell.com.

Our managing director Shri C C Girotra was honoured with the Jaeger Memorial Lecture award in the IC-2020. A condensed version of the presentation "Role of Welding in the Indian Economy" is being published, especially for those, who may have missed it in the conference. An insight is offered to the connection of welding with the national economy. The challenges, developments of the Indian welding industry and suggestions and few thoughts on the way forward are presented.

"Clean and Dust free Facility for Welding Titanium" is an important aspect that needs to be considered by exotic metal fabricators. The details of all the elements recommended to fulfil this end-to-end solution is explained.

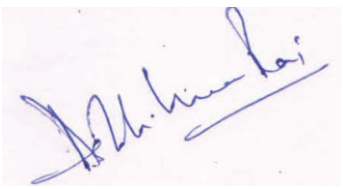
"Welding of 1¼% Cr ½% Mo Steel" discusses the characteristics, applications, and factors to be considered while welding of this grade of steel, especially for the power industry.
"Reduced Gap Technology for Narrow Gap Welding" discusses the new technology developed by Kemppi where in the advanced arc distance control system delivers constant power at contact tip to work distances upto nearly 30 mm.

"Simple Tips to Efficiency Improvement in Welding" lists eight ways to improve welder efficiency and easing of the welding job.

"Weld Purging for P91 Steels" explains one of the solutions offered while welding of P91 steels. This allows satisfactory shielding even where preheating, interpass temperature and post weld heating are involved. "Thermal Spray Process – A Wear Combating Solution" gives an overview and traces the development of this emerging industry.

"The events IC2020 and Weld India 2020" and "Boilers India 2020", both held at Navi Mumbai are covered under the 'Events' section. They give a gist of the conference and exhibition. Weldwell was an active participant in both. In addition, it includes a glimpse of the visitors to Weld India 2020 trade fair.

We, at Weldwell Speciality Pvt. Ltd express our deep gratitude to all well-wishers and visitors for visiting our stall in the Weld India 2020 exhibition. Once again, an appeal to our readers, to offer views and suggestions for improvements to make your magazine more interesting. Kindly confirm your contact details to enable us to ensure receipt of the digital copy of the magazine.



Ashok Rai
Editor
Editor-in-Chief : Dr. S. Bhattacharya
Team members : Kapil Girotra, P.S. Naganathan, Navin Badlani

ROLE OF THE WELDING INDUSTRY IN THE GROWTH OF INDIAN ECONOMY

C C Girotra, Director, Weldwell Speciality Pvt Ltd.
(Condensed from the lecture delivered)

PREAMBLE

The Jaeger Lecture is the prestigious opening address at an International Institute of Welding (IIW) International Congress which elaborates on the theme of that Congress and references the achievements, challenges and potentials for the welding industry as a whole in the region where the Congress is held

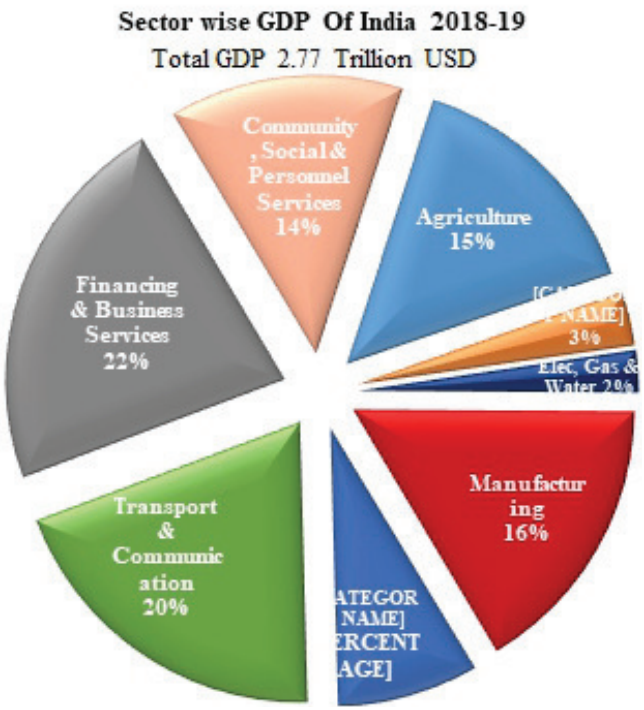
The Jaeger Lecture is presented by an eminent and experienced person from local industry, academia or government in the host country or Congress region. The lecturer is nominated by the Congress organisers and then approved by the IIW Technical Management Board and endorsed by the IIW Board of Directors and is presented with a plaque and certificate commemorating their participation.

The topic of the lecture encompasses the presenter's considerable first-hand knowledge of the status quo of industry in the host country and region, as well as its challenges and future directions. The Jaeger Lecture provides a forum for the stimulation of future development of the welding industry there, and usually includes a call-to-action to the individuals and organisations attending the Congress.

The 5th.International Congress – IC2020 was held in Navi Mumbai by Indian Institute of Welding, Mumbai Chapter. Mr. C.C. Girotra – MD , Weldwell Speciality was conferred the prestigious honour. He spoke on "[Title]ROLE OF THE WELDING INDUSTRY IN THE GROWTH OF INDIAN ECONOMY" - A condensed version is presented herewith

INTRODUCTION

It is an honour to deliver the Jaeger Memorial Lecture at the IC-2020, the Fifth International Conference in my home town, Mumbai. Mumbai is the city that gave refuge to my parents, when our family migrated after partition of India during August 1947.



My interest in welding technology developed way back in seventies while working at the Power Projects Engineering Division of the Department of Atomic Energy. The close interaction with Canadian consultants during development of reactor components indigenously inspired me to pursue welding technology.

The topic – "Role of the Welding Industry in the growth of the Indian Economy" assumes importance with the Government citing intentions to be one of the leading economies of the world by doubling the Indian economy in a span of five years i.e. by F.Y. 2024-25.

GDP - A MEASURE OF ECONOMY

Any discussion on economy automatically connects it to the 'GDP', the total market value of all final goods and services produced in a given time period. The ten-year average annual GDP growth has been 6.4%.

Manufacturing is a key contributor to the economy of a nation, adding jobs as well as increasing self-reliance. National manufacturing policy of India prepared in year 2016 envisaged 25% share in the economy and creating 100 million jobs by end of 2024. The current contribution of manufacturing sector is only 16%. The filling up of this gap is a challenge for welding industry. Please refer to the chart shown giving a comparative contribution to the economy of the major sectors.

To have a robust and thriving economy the contribution of manufacturing sector needs to increase. Since Welding is a major enabling technology for manufacturing, we have ample opportunity to contribute.

DEVELOPMENTS OF WELDING TECHNOLOGY IN THE LAST 50 YEARS

Over the last 50 years, welding technology has undergone much change attributable to a combination of information, research and use of technology. It has led to automation of processes yielding higher productivity, consistent quality, safety and improvements of work environment. This progress has led to; -- This progress has led to; -

- **Process Development:** Application of advance processes, such as electron beam, plasma arc, friction stir, explosion and laser hybrid welding resulting in increase in the range of materials that can be welded. High speed ESW for weld overlay is now much in use.

  Welding power sources are upgraded/modified for specific purposes/advantages e.g. Flexibility - AC/DC combined, RMD/CMT technique for root pass welding, hot wire TIG/twin wire, TIG for higher productivity, K-TIG single pass welding for thin metals etc.; Higher productive processes e.g. industrial robots and computer-controlled systems improve both quality and productivity
- **Advances in Weld Design-capability:** Analytical ability for structures, seismic design, finite element analysis and residual stress analysis is now available.
- **Advances in Material Science :** The developments in materials and understanding their properties have improved. This led to better design and operation of fabricated equipment and systems.
- **Advances in NDT Techniques :** Real time examination and monitoring techniques, use of simulation techniques, machine learning and data analytics for reliable predictability have advanced significantly.
- **Digital Technology:** has led to adaptation of 3D printing for manufacturing of complex components on a large scale and use of IOT is helping in raising productivity and quality

LET US ASK OURSELVES – ARE WE IN INDIA MAKING USE OF THESE DEVELOPMENTS?

The answer is "NOT FULLY". Adoption of advanced / improved welding technologies is limited to large companies. Unfortunately, small and medium scale companies are still dependent on conventional technology due to lack of technical knowledge, shortage of skilled manpower and the capital needed for upgradation. Welding industry as a whole need to put efforts in increasing awareness about advanced technologies and making them available at affordable price through indigenization.

INDUSTRIES WHERE WELDING IS IMPORTANT

Desired growth of economy is possible by laying greater focus on industrial manufacturing. This translates into growth in steel, power, infrastructure / transportation, and petroleum industries among others.

This presentation will cover the contributions that welding makes in some of following industrial sectors:

- **General Construction & Engineering (includes Infrastructure activity):** Infrastructure activities connected Infrastructure activities connected with welding are construction of roads, bridges, dams, stadiums, pipelines, tanks and other engineering construction that uses special metallic material and varying degree of welding. This segment constitutes a large number of small and medium welding fabrication facilities carrying out jobs from a fixed location or mobilise to sites where these jobs are to be carried out. Growth of this segment is linked to growth of general economy of the country and vice-versa. The firms connected with this segment are often referred as EPC contractors. Automation is gaining momentum to reduce overall project completion time besides other linked advantages.

  Presently, most of these fabricators use welding processes of a wide array to achieve high productivity such as Tandem wire MAG welding, laser - MAG hybrid process, SAW, Robotics for subassemblies. Laser and plasma cutting help in fast and accurate cutting of large panels.

  The infrastructure spend by our Government is growing at a CAGR of 10.5 per cent annually and is expected to reach USD 215 billion in 2020. India is witnessing significant interest from international investors in the infrastructure space. Government has recently announced sanction of the world's longest LPG pipeline (2757 Km) from Kandla (Gujarat) to Gorakhpur (UP) at an estimated cost of USD 1.5 billion.

  Another area of large investment in infrastructure in the next five years in India is in the power sector. India is investing in Advanced Ultra Super Critical and the Ultra Super Critical technology to boost fuel efficiency. It is planned to increase current installed capacity from 192GW to 330GW by year 2031.

  On the nuclear power front, currently having only 3% share, Government plans addition of 21 nuclear reactors by year 2031 at an estimated USD 35Billion

- **Heavy Engineering / Capital Goods Fabrication:**
  Heavy Engineering Fabrication is often connected with capital goods requirements from industries such as Power, Petrochemical, Refineries, and Process Plants, requiring reliable and assured long life of the products supplied. This segment employs high end of Welding Technology and is a major source of employment. Automation, including IOT compliant systems becomes often necessary to predict, control and ensure final properties in line with the expectations.
- **Ship Building:**
  Historically, we may say that welding started with ship and barge building involving several kilometres long welding and cutting of varying materials and thicknesses.

  India had commenced shipbuilding activity for naval use including submarines. Today there are many agencies for fabrication of ship, barge, container and other related activities.

  The Indian shipbuilding industry may be classified as welding intensive and will benefit improving delivery schedule and progressively becoming more competitive.
- **Automotive Industry:**
  Automobile industry is one of the major contributors to GDP (7%) during FY 2018-19. Welding forms the core activity to join smaller thicknesses of material requiring significant investment in high productive welding processes such as laser welding and robotic arc welding to weld a large variety of materials maintaining a balance between lower weight and improved functionality. GMAW and Resistance welding processes have come a long way in delivering faster production, lesser rejections and ensuring consistent performance.

  Railway coach and wagon manufacturing extensively use welding of carbon, stainless and Corten steel for their fabrication and India has the distinction of using locally manufactured units since inception. Metro rail, a new emerging segment, will also gain the advantages rendered by new joining technologies..
- **Civil / Defence Aviation:**
  The Indian government accords top priority to expanding the defense and aero-space industry to strengthen its capability to meet global standards of excellence. MRO is a support service to the aviation industry that is also expected to grow proportionately.

  India is projected to become a strong domestic base for manufacturing sub-assemblies and components in the years to come. The cost advantages, availability of well-educated talent pool, the ability to leverage IT competitiveness and a liberal SEZ law, attractive fiscal benefits and are drivers to investment in this sector.
- **Aero Space Industry:**
  India is one of the six countries in the world that has carried out space odyssey. Welding technology is a major contributor to success of this program. GTAW/EB/Friction welding are extensively used to weld the various grades of Nickel Alloys, Al alloys and PH grade steels that are used in the space program..

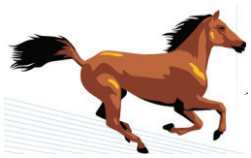
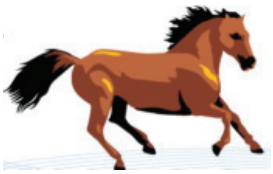
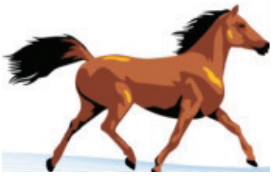
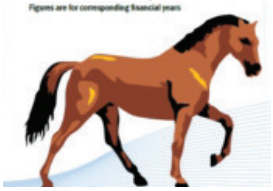
CHALLENGES TO WELDING INDUSTRY IN INDIA (AN OVERVIEW OF TECHNICAL COMPETENCE):

Technology Information, Forecasting and Assessment Council (TIFAC), a think tank set up under the Ministry of Science & Technology, has brought out TECHNOVISION-2035 to assess overall technological progress in India. It has used the metaphor of horse gaits, Gallop, Canter, Trot and Walk, as an analogy for how India has progressed. It is presented in the following pictorial depiction.

The chart shows a mixed picture of achievements and missed targets. While we have made quantitative leaps, the concomitant qualitative technological improvement is still only a desire.

WAY FORWARD FOR WELDING INDUSTRY

To proceed further, a discussion on summary of overall needs and challenges faced by Indian welding industry and way forward will be appropriate.

GALLOPING INDIA  **Successfully Deployed**	 **Space, Missile & Nuclear Technologies have shown significant progress**
CATERING INDIA  **Pilot Plant Stage**	 **Civil Aviation & Road Transportation are in the growth pace**
TROTTING INDIA  **Being Developed**	 **Engineering, Materials & Processing has gained confidence, but need to step up growth**
WALKING INDIA  **Needs greater focus**	 **Advanced Sensors for Automation and Waterways, yet to take off**

Needs & Challenges	Way Forward
Scale Up	• Invest in AI, IOT tools and advanced power sources to achieve higher productivity, consistent quality and lower cost
Educate	• Need to spend on education, skill development on top priority • Health and safety awareness of the welders must be emphasised
Innovate	• Need to encourage the spirit of innovation • Private sector in their own interest should encourage R&D • Need to support students and faculty in their R&D efforts and in commercialisation • Government in partnership with Industry to work on incentives to augment research activities, promote innovation and improve academic industry interaction
Standardize	Use, promote standards for design, production and quality control • Promote international welding standard ISO 3834 which is designed exclusively for welding operations
Form apex regulatory body	• IIW-India should take proactive action for upgradation of welding technology competence. • Form a multi-disciplinary think tank which will periodically assess / report and make forecast of our competence level and recommend steps for continuous improvement. • Coordinate and synchronise R&D activities with the Govt. and private sector units to avoid duplication of efforts and reduce cost

ROLE OF WELDING TECHNOLOGY IN NATIONAL ECONOMY

It is important to have a vibrant welding sector since it has significant impact on cost, quality and delivery schedule of various manufacturing industries which in turn will affect the economy. Determining the contribution of welding to the economy directly is not feasible and can only be done indirectly.

The total Indian welding market size is estimated to be USD750 Million. The breakup of consumables and equipment is 80:20 ratio. The quantity of Welding consumables used by India is approx. 450kTonnes per annum.

The market survey reveals that use of SMAW process still exists to a large extent though high productivity processes too are gaining market share. Welding consumable industry is dependent on import of many raw materials including core wires particularly in the high-end segment (approx. 20%). However, dependence of equipment industry on import is much higher – 40-45%. This is an area of concern as it consumes precious foreign exchange and therefore should encourage indigenous developments.

CONCLUSION

- It is evident that in order to achieve targeted GDP of 5 trillion USD we have to increase share of manufacturing sector to 25%. Welding productivity coupled with enhanced quality will play a major role in achieving the same.
- We need to give top priority to education and skill development in order to innovate processes and increase productivity.
- We have reasonable level of competence in welding technology. However, these are limited to large and organized sectors of our country. We need to spread this knowledge to MSME sector, academics and R&D organizations to achieve a 'critical mass'.

SUGGESTIONS

- Promote pro-manufacturing policies - Professional Associations like IIW-India should play active role in advocating policy changes to the Government
- Promote “Make in India" products and enforce quality standards. This will create a healthy image of welding for the youth
- Create a regulatory body / think tank of multi-disciplinary background for conducting tech audit, study 'successes' and 'gaps' and propose suitable corrective measures.

CLEAN ROOM FACILITY FOR TITANIUM WELDING

By Navin Badlani, Ashok Rai, Santosh Patil nivek@weldwell.com

INTRODUCTION

Titanium and its alloys are the metals of choice for applications such as in the aerospace and additive metal manufacturing industry. They are chosen mainly because of the following properties:

- High strength to weight ratio
- Corrosion resistance
- Good Mechanical properties at elevated temperatures

The weldability of Titanium is reasonably good and can be welded by any of the conventional processes. Gas Tungsten Arc Welding (TIG welding) is the most preferred process in both manual and mechanized applications.

Titanium burns in pure oxygen at 6000°C; in nitrogen at 8000°C, and harmful brittle carbides, nitrides and oxides tend to form when exposed to air at temperatures above 3000°C leading to hydrogen embrittlement of the metal. It thus follows that the reactive titanium metal does not take kindly to air contamination, and it is commonly assumed that welding titanium is difficult. This is overcome by knowledge, practice and following good practices.

Conventionally, the exotic material fabricators used to customise each and every tool to meet the critical requirement of purging and dust free environment, which was huge in cost. Weldwell now offers a turn-key solution, which includes important features such as Dust free cabin; Flexible welding enclosure, Gas Manifold system; Weld Purge Monitor; Welding Power Source; Accessories like Weld Trailing Shield, Tungsten Grinder, Customised SPM for holding and rotation of jobs inside the enclosure etc.. Suitable Dehumidifiers and Air conditioners are also available as options. Such turnkey solutions have been successfully installed, along with training to many fabricators involved in the aerospace industry.

Fig 1: Dust-Free Cabin

The foremost consideration, while welding Titanium, is need of a clean environment isolated facility. There is no need of any high-tech white clean room, but a dust-free cabin of suitable size, properly insulated and equipped with necessary electrical fittings, fulfils this requirement. An air curtain is also provided at the door opening, to sanitise all personnel and material on entry. The inside layout takes care of placing of welding enclosure and other accessories, as required. The complete cabin is completely dust-free, moisture free; clean of oil and grease and free of air drafts, as turbulent air can draw in oxygen, leading to contamination.

FLEXIBLE WELDING ENCLOSURE

For applications which require X-ray quality and oxide-free welds, such as in titanium welding, it is important that the welding zone is purged of oxygen to a level as low as 10 ppm and the complete welding zone is always shielded with inert gas, such as Argon, to secure corrosion resistance.

Atmospheric contamination is best avoided using a welding chamber or glove box that can be filled with argon and encloses the complete weld area. The rigid glove boxes used earlier being costly, a special flexible enclosure is preferred. The Flexible Welding Enclosure (shown in Fig.2), manufactured by Huntingdon Fusion Techniques, is one of the most suited, ideal, low cost solutions. It incorporates access ports for welding torches, electrical leads and water-cooling supplies. A purge gas entry port and an exhaust valve are available as standard features to vent displaced gas into the atmosphere.

Fig.2 Flexible Welding Enclosure

DISTINCT ADVANTAGES/ FEATURES:

- This enclosure, made of special combination of translucent and optically clear sheet material, gives generous all-round visibility and well-laid out controls provides appropriate hassle-free work environment. Safety and clear vision is the hall-mark of these welding enclosures.
- To prevent any type of contamination and oxidation, the flexible welding enclosure has all-round zips and a special clamping arrangement that allows loading and unloading of the material without emptying the whole system. Air-locking and leakproof tightness is ensured.
- The planned layout provides for work to get started straight away. Operator comfort and ease of use are distinct advantages over rigid enclosures. SPMs, such as rotators and fixtures, ensure better rapid pre-welding cycles, saving overall time and costs.

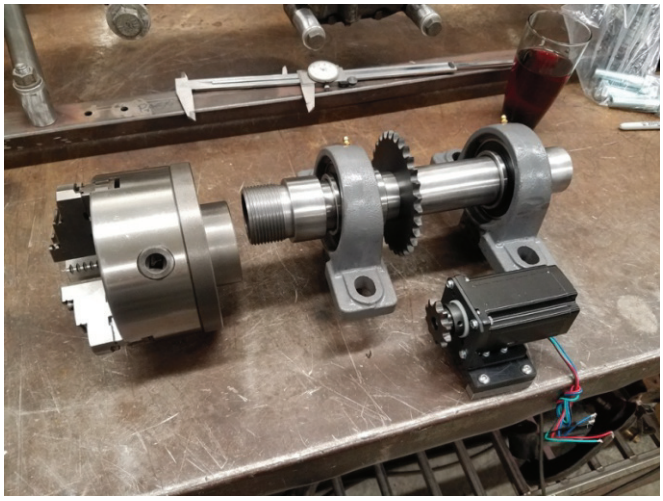


Fig 3: Work elements

- The special arrangement of gas distribution on the stainless-steel work base plate does not allow any air traps to be created inside the enclosure and provides defect-free titanium welding. (Refer Fig.4)

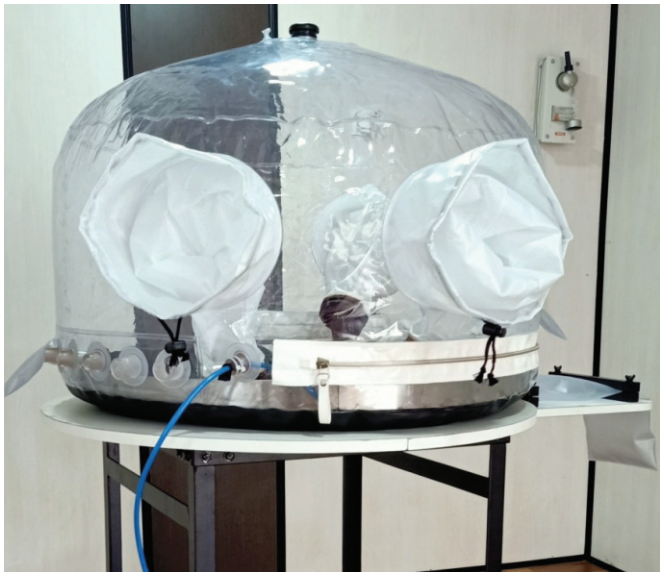


Fig 4: Gas distribution arrangement

In conclusion, the flexibility, high visibility, rapid pre-welding cycles, gas-distribution arrangement and ergonomic work area combine to make a flexible enclosure an educated choice.

Note: The flexible enclosure, work elements (holding fixtures, rotators etc.) and the placement of gas manifold can be customised.

In addition, storage of welding consumables and/or other tools can be provided for in the enclosure

GAS MANIFOLD SYSTEM

Suitably designed Gas manifolds with gauges are placed just outside the cabin. The manifold is connected to a bank of Argon Gas Cylinders of very high purity that are required for welding titanium.

Fig 5- Gas manifold

WELDING PURGE MONITOR

The crucial factors while welding exotic metals like Titanium are taken care of, by providing a clean environment and shielding with high purity inert gas throughout the welding process. The maximum tolerable limits in the weld metal have been estimated as 0.3% oxygen, 0.15% nitrogen and 150 ppm hydrogen. Therefore, it is imperative that continuous monitoring of gas purity--oxygen content before, during and after welding--is done. Weld purging of the weld zone, down to as low as 10 ppm, is recommended for greatest weld joint strength and highest resistance to corrosion.

Errors in gas purging lead to qualitatively unacceptable results. Therefore choosing a suitable weld purge monitor from the variety available in the market is crtical. Huntingdon manufactured PurgEye 300 Nano is the most suitable weld purge monitor.

This affordable and accurate monitor is lightweight, top class and inexpensive, with a long life sensor and a warmup time of less than 60 secs. It can be used with optional accessory hand pump and a gas sampling probe.

The ability to set up automatic purging cycles and purge up to 10 ppm is an added advantage for titanium welding, with a low range in which welding can be effected.

Overall, it is an optimum instrument which has a stable, high-

speed performance ideal for weld purging during exotic metal welding.

WELDING POWER SOURCE

The equipment and techniques used in welding titanium are similar to those required for other high-performance materials, such as stainless steels and nickel based alloys. In general, titanium and its alloys can be welded with most conventional power sources. However, welding titanium demands greater attention to cleanliness and use of auxiliary inert gas shielding. The inert gas-shielded process (GTAW) is well suited for joining titanium and titanium alloys. This process can be performed using manual, semiautomatic, or automatic equipment in a chamber or an open-air environment with auxiliary inert gas shielding. Inert gas from the torch maintains the arc and protects the tungsten electrode and weld pool from atmospheric contamination. Welds can be made autogenously (i.e. without filler metal) or with the addition of wire. GTAW can be performed in all positions and is the only process routinely used for orbital pipe welding of titanium.

The GTA power source requires certain advanced features for exotic material welding. All these requirements and control of parameters are available in “Kemppi Master TIG MS3000” described below.

- Water-cooled having 300 A Output current
- 60% faster set-up & 20% lower noise levels
- Both the features of Spark TIG (TIG HF) or contact TIG are standard.
- The remote controlled contactor or foot pedal controls both the welding current and the contactor.
- Preflow and postflow timers for torch, trailing, and backup shielding are available for protection from atmospheric contamination.
- Welding torches can be used at 100% duty cycle without overheating. Torches are fitted with oversized gas cups and a gas lens, which are mandatory for welding titanium compared to those used for welding other materials. The large cup and lens allow the tungsten electrode to be extended beyond the cup for visibility or welding in areas of limited accessibility
- Auto-pulse provision is also an advantage

Tungsten Electrode Grinder

In TIG welding of exotic metals like titanium , the tungsten electrode is one of the most important variables. Both, 2% thoriated and 2% ceriated tungsten can be employed and the tungsten shape can vary with welder preference. However, perfect grinding parallel to the axis of the tungsten electrode is important for optimum performance. Using an incorrectly ground tungsten electrode tip can lead to rejection due to tungsten inclusion, reduction in tip life and changes in arc voltage and additional costs. Preparing tungsten electrode properly helps in arc stability, and weld quality. Tungsten Grinders, like the Tungsten Electrode Grinder (TEG-1000) manufactured by Huntingdon Fusion Techniques, is one of the most convenient, safe and accurate way than other ways of grinding.

Fig.7. TEG-1000

The diamond grinding wheel, provided, produces smooth, perfect surface finishes that eliminate arc jumping, leading to consistent welds. The collet / tungsten holder can be maneuvered and positioned to get the desired profile. Sizes 1.0 to 3.2 mm can be ground as standard.

The locking of the tungsten holder would enable to get repeatable tungsten points, enabling consistent arc performance and weld results.

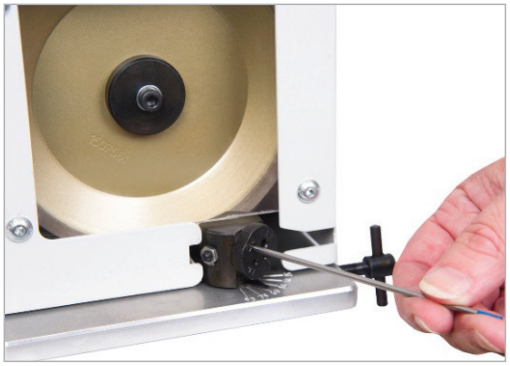


Fig.8 shows zoomed view of the grinding technique

TRAILING SHIELDS

Accurate fit-up is more critical for titanium than for other materials. Uniform fit-up minimizes irregular root fusion, helps control under bead contour, and reduces distortion. Poor fit up increases the possibility of contamination from air trapped at the joint interface. Whenever possible, joints should be clamped rather than tack welded. All clamps and fixtures should be clean and grease free. When tack welds are used, the same cleaning and shielding requirements as used for all titanium welds should be employed, including the use of high purity argon.

The function of the trailing shield is to blanket the solidified weld and adjacent heat-affected zone with inert gas until the surface temperature has dropped to below 800°F (427°C) or such that no visible oxide colour forms on the surfaces. The trailing shield can be attached directly to the gas nozzle on either manual or automatic torches.

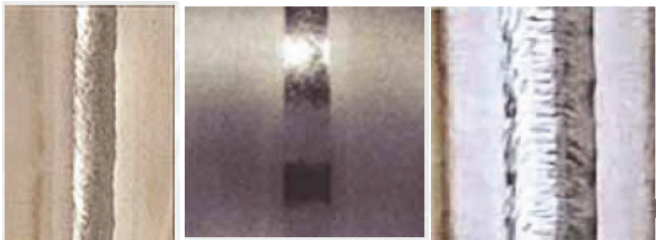
Huntingdon Fusion trailing shields are engineered and available as straight for plates and profiled according to the curvature of the pipes. Fig. 4 & 5 show trailing shields configured for straight plates and for outside welding of pipes, respectively. The width and length of the trailing shield is a function of the welding heat input and must be determined for each particular joint design during welding procedure development. If the trailing shield is too short, excessive oxidation on the surface of the solidified weld will occur (indicated by visible surface colour). A shield about 4 in. in length and 1½–2 in. in width is suitable for most manual work.

Fig. Straight and profiled Trailing shield

For video, please click below youtube link
https://www.youtube.com/watch?v=Y9DgCTrNQdc
Contact: nivek@weldwell.com
for further details and supply

TITANIUM COLOUR INDICATES WELD QUALITY

Acceptable Colours



Silver / Bright Silver – Excellent gas coverage – 10 ppm level

Light Straw / Dark Straw
Slight oxidation – higher oxygen level

"Courtesy: Huntingdon Fusion Techniques"

REDUCED GAP TECHNOLOGY (RGT) FOR NARROW GAP WELDING

By Jernstrom, P; Sasrivarta,H & Uusitalo,J - Kemppi

INTRODUCTION

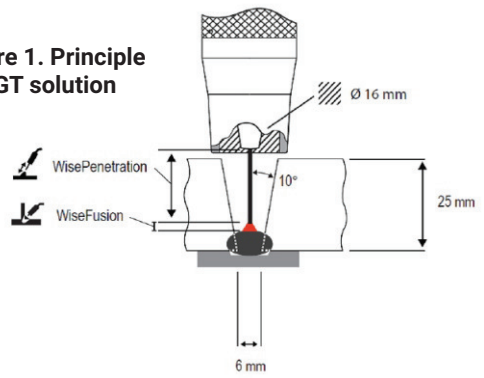
Reducing the groove angle can add significantly to efficiency and productivity of welding of heavy metal structures. Conventional narrow gap welding can be applied with most welding processes, but it has a disadvantage too. It is practically impossible without equipment especially designed for the application. To overcome this constraint, Kemppi has developed a new solution, Reduced Gap Technology (RGT). This technology allows reliable and efficient narrow gap welding with no need for special equipment or accessories for material thicknesses of up to 30 mm. The solution combines intelligent arc control with Kemppi's high-tech power source, wire feeder and mechanization equipment

RGT CHANGES OUR UNDERSTANDING OF NARROW GAP WELDING

In narrow gap welding, the groove angle is typically less than 20 degrees instead of the normal 45 to 60 degrees. This decreases the number of weld passes needed to complete the joint, and it reduces the welding time and weld metal. It also makes the weld structure less prone to distortion. In other words, reducing the groove volume has a multitude of positive effects on welding quality, efficiency and productivity. However, reducing the groove angle also brings more challenges to welding. In a narrow groove. This may result in quality issues unless you invest in welding torch and accessories that are specially designed for the application. For narrow gap MIG/MAG applications with material thickness below 30 mm, Kemppi's Reduced Gap Technology (RGT) is an ideal new solution. It allows using of standard welding equipment and welding application software for narrow gap welding of butt joints and fillet joints. The RGT solution combines the benefits of Wise application software, FastMig or X8 MIG Welder equipment, and A5 MIG Rail System 2500 welding mechanization system. A control system ensures consistent power and precisely focused arc.

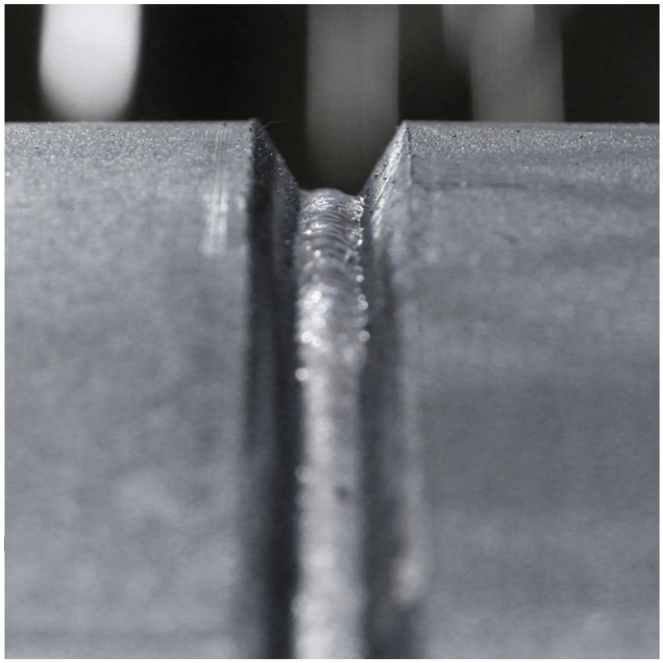
At the core of Kemppi's RGT solution is the most advanced arc control system available, which delivers consistent arc power at contact-tip-to-work distances of up to about 30 mm. In addition, the system adaptively adjusts the arc to keep its energy density at the maximum level (see Figure 1 below).

Figure 1. Principle of RGT solution



A short, stable, and efficient arc minimizes the risk of incomplete penetration and lack of fusion, because the arc is always focused precisely on the desired point in the groove. The RGT control system enables reliable narrow gap welding of materials with thicknesses up to 30 mm, without the need for special equipment or accessories.

The principle of the RGT control system is that WisePenetration* maintains consistent arc power regardless of variation in the contact-tip-to-work distance while WiseFusion** provides adaptive regulation that keeps the arc focused and optimally short. In X8 MIG Welder, all of this functionality is combined in WisePenetration+** function. [* ***WisePenetration*** - an optimized welding function is designed to keep welding current and thus penetration invariable regardless of the changes in stick-out length in manual welding. ** ***WiseFusion*** - A welding function that ensures consistent weld quality in all positions by automatically regulating arc length. Creates and maintains an optimal short circuit characteristic in pulsed MIG/MAG and spray arc welding.]



ADVANTAGES OF KEMPPI'S RGT

Narrow gap welding provides many benefits, and in addition to those, Kemppi's RGT solution offers many further advantages for still greater cost savings and added value:

- Investment costs are low since no special equipment is needed in welding material of thicknesses under 30 mm * WiseFusion keeps the arc stable, improves the control of the weld pool and reduces the magnetic arc blow. This decreases the risk of incomplete penetration and lack of fusion resulting in lower repair costs * WisePenetration keeps the arc power consistent regardless of variations in the contact-tip to-work distance. This enables a higher welding speed and deposition rate and it results in lower labour costs.

- The high energy density of WiseFusion minimizes heat input, which improves impact toughness with high-strength steels and reduces deformation, so there is less need for straightening.
- WiseFusion keeps the arc length stable. The user doesn't need to adjust it offering for less hassle and a better arc time ratio.
- The A5 MIG Rail System 2500 rail carriage is optimized for use with FastMig power sources. Power to the rail carriage is supplied through Kemppi's special torch without additional cables, so getting the system ready for operation is fast, and arc time ratios are better than before.
- Remote control of the A5 MIG Rail System 2500 enables quick and easy adjustment of the carriage functions and power source welding parameters. Therefore, the operator can focus on monitoring the welding. The result is fewer welding imperfections and lower repair costs
- Reduction of groove volume leading to lower filler metal consumption saving costs. Potential savings is illustrated by following example.

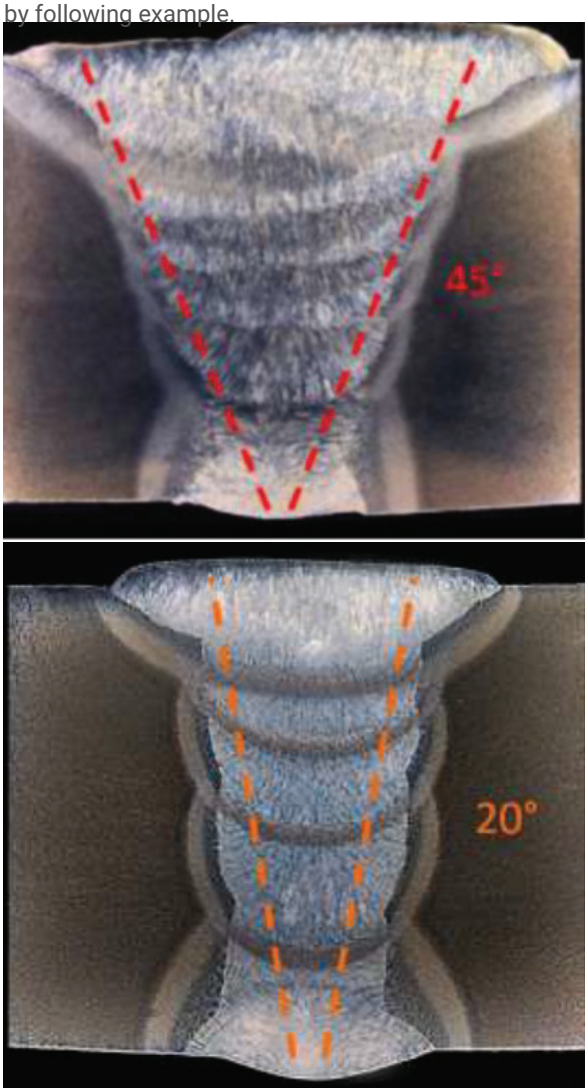


Fig.6: RGT 5 weld passes

RGT CHANGE EFFECTS :

- **Groove Angle** - Reduced from 45* to 20*
- **No. of Passes** - Reduced from 7 to 5
- **Root Gap** - Increased from 4.0 to 6 mm
- **Root Face** - Reduced from 1.5 mm to 0.0 mm
- **Reinforcement** - No change
- **Weight of Weld Metal** - 2.9 to 2.2 Kg/Mtr.
- **Arc Time Savings** - 38%
- **Filler Metals Savings** - 25%

DEVICE AND SOFTWARE REQUIREMENTS

The narrow gap welding solution is available for Kemppi's FastMig KMS, FastMig M, FastMig Pulse, FastMig X and X8 MIG Welder equipment. Use of this solution requires that the machine is equipped with the WisePenetration and WiseFusion application software. With X8 MIG Welder, only WisePenetration+ is needed, as it includes all necessary functions. The required Wise application software products are easy to purchase and install after machine purchase. To optimize usability and welding efficiency, it is recommendable o use this technology with the A5 MIG Rail System 2500 (see Figure 7).

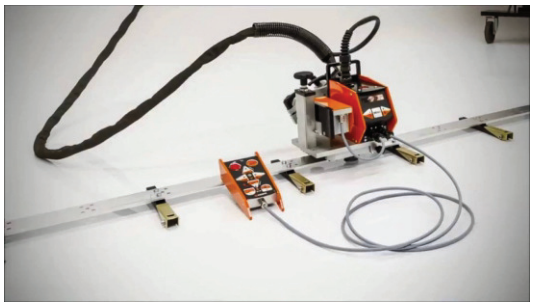


Fig.7: A5 MIG Rail System 2500

SUMMARY

The RGT narrow gap welding solution developed by Kemppi is based on an intelligent control system that keeps the arc power consistent regardless of the variations in the contact-tip-to work distance. In addition, the system controls the arc adaptively to keep its energy density at the maximum level. A short, stable, and efficient arc minimizes the risk of incomplete penetration and lack of fusion, because the arc is always focused precisely at the desired point in the groove. The control system enables reliable narrow gap welding of materials with thicknesses of up to 30 mm, with a 20° groove angle from one side, and without the need for special equipment or accessories. The software in the welding equipment serves the purpose. Smaller groove volume yields significant cost savings through reductions in welding time and filler-material consumption. The method is excellently suited to both butt and fillet joints, no matter the welding position. To optimize usability and welding efficiency, using the solution with the A5 MIG Rail System 2500 is recommended.

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The International Institute of Welding and IIW-India's Mumbai Chapter organised 5th. International Welding Congress and concurrently held the 13th Weld India Exhibition, of the country in association with the International Institute of Welding at CIDCO Convention centre in Navi Mumbai between 6th to 9th February 2020. The International Welding Congress was inaugurated by lighting the lamp at the hands of Chief Guest- Mr. P. Madhusudan, CMD of A P High Grade Steels Ltd, Guest of Honour, Mr. Y S Trivedi, Sr. Vice President & Member of Board, HEIC, L&T Ltd; Mr. Douglas R. Luciani , President International Institute of Welding and Mr. Parimal Biswas – President, IIW-India, along with members of IIW in attendance.

The august gathering was addressed by Chief Guest Shri P. Madhusudan; Guest of Honour Shri Y.S Trivedi, as the keynote speaker and various IIW officials. Then followed the invited lectures – The Jaeger Memorial Lecture by Mr. C. C. Girotra, the Keith Hartley Memorial Lecture by Mr. Abby Joseph, the Dr. Placid Rodriguez Memorial Lecture by Dr. M. Amrithalingam and the Dr. G. L. Goswami Memorial Lecture by Mr. R. Srinivasan. These invited lectures were eagerly heard and appreciated by all present

"Advanced Welding Technology & Quality Systems for Developing Economies" was the theme of the congress. The topics of the invited lectures i.e. "Role of Quality Assurance in Welding to Meet Consistency' and the "Role of the Welding Industry in the Growth of Indian Economy "set the tone of the proceedings.

The multiple sessions held, received a highly encouraging response in terms of participation wherein more than 150 technical papers by national and international engineers were deliberated upon. A separate session, titled "Young Professional International Congress" was held for young, enthusiastic welding professionals also a special session was conducted on "Weld skill development". The session gave an insight to the delegates to in understanding the new techniques that can be used to reduce the gap in the needs of the skill development.

The proceedings of the congress included topics in the latest welding technology, metallurgy, material testing, non-destructive testing, speciality welding and fabrication. At the Congress, the Indian welding fraternity interacted with over 250 highly reputed and experienced welding engineers from all over the world. Awards for various categories. sponsored by reputed organisations, were distributed in the Inaugural Session of the Congress.

The four- day long 13th Weld India Exhibition was inaugurated by Sanjay Kedia - Chief Mech Maintenance, Steel Making, Tata Steel, Mr. Douglas Luciani President - International Institute of Welding, Mr. Chris Smallbone - IIW Australia, Mr. Keyur Sanghvi - Chairman of Exhibition Committee, Weld India and Mr. Parimal Biswas - President, IIW-India. The Event saw visitors coming from across the country and even abroad. Over 75 leading manufacturers and distributors participated from as many as 22 countries. Most of them showcased many new products with cutting edge technologies.

Weld India 2020 was focused on reputed international and indigenous hi-tech welding equipment & consumables including automation techniques and solutions offered by leading Industries. Non-destructive testing and other inspection techniques were also displayed. The focus was also on the use of digitalisation and artificial intelligence as the key to improving the fabrication quality in the country.

IIW, under the guidance and support of National Skill Development Corporation, were seen actively working to close the gap of skilled manpower needed to achieve the objective of making India a $5 trillion economy.

The conference IC 2020 and Weld India 2020 received an overwhelming response and benefits to the welding fraternity would surely accrue in the days to come.

A glimpse of the visitors to Weld India can be seen overleaf.

WELDINDIA 2020


Panasonic
Panasonic
Panasonic


SPECIAL METALS
SENTESBIR
Panasonic


THERMAL SPRAY POWDERS
PAC


SPECIAL METALS
KOTTON


When you need...
Critical Welding Products
Think of

INTRODUCTION

Alloying elements are added to steel to improve its mechanical and other properties. The amount of alloying elements may vary between 1% and 50%. Amongst the alloy steels, when Ni, Cr, Mo and other alloy elements content is less than 10.5%, they are defined as low alloy steels. The low alloy steel series which contains 0.5% ~ 9% Cr and 0.5% ~ 1% Mo are often grouped in a single category, referred to as chrome moly, croalloy, chromalloy or CrMo steel. The amount of chromium, molybdenum, and other alloying elements determines the assigned grade. Further development, by adding elements such as V, W, Ni, Ti, and N has led to newer grades like T/P 22; T/P 23; T/P 91; T/P 92, etc. and have been tried out for specific applications with success.

This article deals with the applications and welding of 1.25Cr-0.5Mo steels

CHARACTERISTICS & APPLICATIONS

The added reliability provided by chrome moly steel means that it is the material of choice for several applications. Most of the grades can withstand service temperatures higher than 500°C.

The main characteristics of Cr-Mo steels, which are exploited for its application, are good creep strength at high temperature, rigidity, hardenability, wear resistance, corrosion resistance - (due to the principal alloy chromium), fairly good impact resistance (toughness), relative ease of fabrication and the ability to be alloyed in various ways that create "fitness for use" for a wide range of applications. Low alloy steels also offer greater resistance to hydrogen attack in such operations as cracking and reforming.

Yield strength is the main design parameter used in advanced codes for pressure vessels and the gain in yield strength is valuable. Low alloy steels make it possible to have thinner walled pressure vessels. Low alloy steels such as 0.5 Mo, 1.25 Cr Mo and 12 CrMoVW, are used for their creep properties in applications such as steam boilers, refinery crackers and reformers. The upper temperature limit for low alloy steels is about 600°C.

ASTM SA387 Grade 11 defines 1¼ Cr-½ Mo steels. Minor additions of the elements, like Cr and Mo, to standard carbon steels provide creep resistance at elevated service temperatures. Typical applications utilizing SA387 Grade 11 material include reactor vessels and coke drums for refinery operations and basic oxygen furnaces for steel mills. These large structures have wall thickness from 25 to 75 mm, are 6.5 to 11 m in diameter and between 24 to 36 m high. A Coke drum endures the most severe thermal cyclic services, with temperature reaching as high as 538°C followed by a water quench. Typical service involves two thermal cycles per day and an estimated vessel lifespan of 3000 cycles.

Bulging of coke drums is a common problem. It is caused by thermal fatigue exacerbated by the differential yield strength of the base metal and that of the weld. Higher-strength weld metal has a stiffening effect, resulting in stress concentrations and ultimately leading to distortion and subsequent cracking. The lifespan can be prolonged without changing the base material, by lowering the quench rate, matching the weld metal yield strength to the base metal, and minimising residual stresses. Current vessel design, fabrication and construction have developed from more than 60 years of experience.

WELDING OF 1 ¼ Cr - ½ Mo STEEL

Cr-Mo vessels, including those cladded with stainless steel, were welded and placed in service from 1940s onwards. Plate material was not standardised, but was typically designated as SA301 which later evolved into SA387, grade. Weldability was poor, compared to modern standards, but quality welds were still possible with highly trained welders. By 1954, low-hydrogen electrodes were introduced that vastly improved the weldability and crack resistance of materials.

Historical construction documents show that obtaining uniform preheat was difficult, but was considered an important factor in producing acceptable welds. Repairs were specially prone to cracking, due to localised heating and relatively high hydrogen content of the cellulose coated electrodes popular in that era. It was recognized that there were common factors that led to cracking during construction and a shorter and unstable lifespan of vessels fabricated from CrMo steels. These factors were:

- Hydrogen contamination
- Temper embrittlement
- Stress Concentration

The need to overcome these factors prompted research to improve welding processes.

Recognition of these common factors, which often led to cracking during construction and a shorter unstable vessel lifespan, prompted research to imrove the welding processes and provided the base knowledge for the formation of codes and standard practices, such as API 934 C for Material and construction of 1¼ Cr - ½ Mo Steel Heavy Wall Pressure Vessels for High Pressure Hydrogen Service Operating at or below 441°C.

In principle, low alloy steels are all weldable and all arc welding processes, such as SMAW, GTAW, GMAW, SAW and FCAW can be used.

A weld profile can also affect local stress concentrations. All welds must be profiled to eliminate sharp concentrations and excessive reinforcement. Grinding interior weld joints, specially girth joints, to flush, smooth and blended finish is common practice in coke drum fabrication.

Although handbooks for welding, welding equipment suppliers and other sources say these alloys are readily weldable, extreme care and caution are highly suggested. These steels being air hardenable, specific care is required in selecting right welding consumables, welding parameters and post weld heat treatments. For manual processes it is important to control heat input to avoid weld zone cracking.

Mechanical properties, such as tensile strength, yield strength, elongation and reduction of area are also important in reference to the material's ductility. This information helps one determine the appropriate welding process, the filler metal type, the preheat and the post weld heat treatment (PWHT) temperatures.

Charpy V-notch tests also can be very useful for determining the material's toughness. As previously mentioned, because the material is susceptible to hydrogen attack, cleaning is critical. The weld area and at least 100 mm on each side of the weld should be super clean. The welding procedure should specify cleaning methods, such as blasting, grinding, wire brushing, and/or chemical. A good chemical may be the citrus type recommended for weld cleaning.

PREHEATING

Preheating is not an option! It is a must! The minimum preheat and interpass temperature must be at least 175o C for materials less than 12 mm thick and 230 to 285 degrees for greater thicknesses. The preheat temperature must be carefully maintained until the welding is completed. One of the most frequent problems with welding this material is allowing the heat to diminish ahead of the weld. This is especially true with thicker material. The method of preheating (whether by local torch heating, furnace, or electrical wrap) should be based on the overall size, thickness and, of course, available equipment. A finely controlled thermo-recordable method always is preferable to the local torch method. This resistance-type equipment typically is readily available for rent.

IMPORTANT CONSIDERATIONS FOR WELDING CR-MO STEELS

- Heat input should be controlled to prevent hot cracking and ensure mechanical properties of the weldment and the base material are matching it is recommended to confirm the performance of the consumables selected for the job.
- Electric polarity affects the usability of welding consumables and the chemical composition and mechanical properties of weld metals needs special attention; therefore, it is recommended to confirm the performance of the consumables selected for the job.
- In the welding of Cr-Mo steels it is essential to know how to prevent hot, cold, and delayed cracking. Hot cracking can be prevented by controlling heat input and appropriately repairing welding groove configuration. To prevent cold and delayed cracking, preheating and interpass temperature is predominant. The most appropriate preheating and interpass temperature depends on the type of steel, thickness of components, and diffusible hydrogen in weld

Unless in conflict with job specification Kobe Steel recommends the following minimum preheating and interpass temperatures for general applications as shown in Table 1

STEEL TYPE	ASTM Plate	Preheat & Interpass Temperatures * C
0.5 Mo	P1	100- 200 * C
1.25Cr-0.5Mo	P11	150 – 300 * C
2.25Cr-1Mo	P22	200 – 350 * C
2.25Cr-!MoV	P22V	200 – 350 * C
5Cr-0.5Mo	P5	200 – 350 * C
9Cr-1Mo	P9	250 – 350 * C
9Cr-1Mo-V-Nb	P91	200 – 350 * C

Table 1: Recommenced preheat and interpass temperature

WELDING CHALLENGES

Preheat and postheat methods are always being pushed for faster application while providing improved energy efficiencies. Heating rates and temperature controls can be improved with modern gas burners and electric resistance heater formed to fit the vessel shell. As previously noted, PWHT must consider the temper of the plate material, as surpassing this temperature may have detrimental effect on the material properties. Owners and end users often require multi thermal cycles, allowing for subsequent repair followed by PWHT, thereby increasing the life of the vessel. Retaining mechanical properties after several PWHT operations is difficult for both the base material and the weld. Ultimately, the life of a vessel is limited by the material to which it was designed and the conditions of its operation.

Cleaning of used material is extremely important while welding. Foreign materials, especially those that produce carbon, can cause serious problems during welding. It often is advisable to blast the material to near white and then apply a chemical cleaning process before welding.

The AC waveform control used in SAW is a recent modification to the process. This AC waveform technology allows greater control of the depth of penetration and deposition rates, while using the same consumable / flux combination. These techniques are easily applied to shop-built vessels decreasing production time.

WELDING CONSUMABLES

Advances in welding consumables manufacturing processes, driven by the need to limit trace elements and lower diffusible hydrogen, have given the industry many good options for welding chrome-moly materials. Most Cr-Mo SMAW consumables can easily meet the requirements, while providing excellent weldability. Modern submerged arc welding (SAW) electrodes also have excellent chemical makeup. When used in conjunction with significantly improved SAW fluxes these consumables result in minimal cracking, smooth weld beads and good operator appeal. While significant improvements have already created good consumables for SMAW and SAW, flux cored arc welding (FCAW) remains a new product to the market. History shows that careful evaluation of material are required to ensure that all design requirements are met by any new product. In general, creep resistant Cr-Mo steels are

welded with matching consumables to have a homogeneous welded joint with about equal mechanical properties. with assurance of meeting the stringent requirements especially as, the heat affected zone (HAZ), that is considered part of the weld. Use low-hydrogen electrodes and filler metal with this material. The standard AWS welding consumables for welding of 1 ¼ Cr - ½ Mo are E8016-B2 for electrodes and ER80S-B2 for filler wires.

SMAW ELECTRODES

To prevent occurrence of temper embrittlement (decrease in impact toughness), weld consumables with extremely low impurity and oxygen level are used. Based on these common theories on the causes of temper embrittlement, Kobe Steel has researched extensively to develop electrodes meeting AWS specifications E8016-B2 (such as CM-A96MBD suitable for DCEP) that fulfils the strict requirement for heavy-wall pressure vessels. The chemical composition of the product is given below:

Trade Desig. Application.	CM-A96MBD (1-1.25Cr-0.5Mo)	
Size and Welding Position	4Ø 45° Vertical Up	5Ø Flat
C (%)	0.06	0.06
Si (%)	0.37	0.49
Mn (%)	0.76	0.79
P (%)	0.006	0.006
S (%)	0.004	0.004
Cu (%)	0.01	0.02
Ni (%)	0.03	0.02
Cr (%)	1.29	1.30
Mo (%)	0.57	0.56
Sb (%)	0.002	0.002
Sn (%)	0.002	0.002
As (%)	0.002	0.002
X-bar[2]	8	8
J-Factor[3]	90.4	102.4

Table2: Typical chemical properties of CM-A96MBD

The X-bar (X < 15) [X = (10 P + 5Sb + 4 Sn+ As) /100] shown in Table 2, is the index of control against the susceptibility to temper embrittlement of the weld metal: the higher the index, the more susceptible the weld metal becomes. To confirm the ~temper embrittlement susceptibility, Charpy impact testing is conducted for the weld metal in the as PWHT and PWHT + step-cooling - Figure1 conditions.

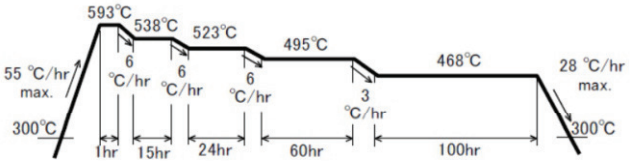


Figure 1: Step-cooling (SC) heat treatment (Socal No. 1).

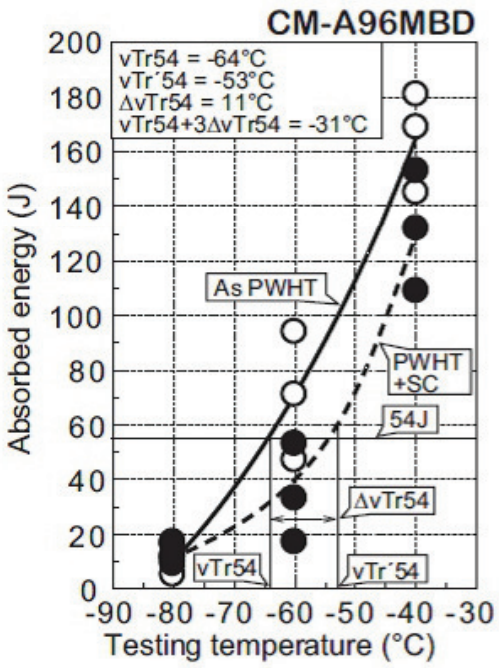


Fig. 2 Plotting of Absorbed energy with temperature during temper embrittlement test

Typical Charpy impact test results of CM-A96MBD weld metals (Fig.2) in the as-PWHT (690°C x 8 h) and PWHT+ SC (4Ø, 45-deg. vertical-up position) confirm their high resistance to temper embrittlement.

GMAW/GTAW FILLER WIRES

With the gas-shielded processes it is vital to assure proper shielding of the weld. Due to the high preheat, the gas-shield can be distorted and provide less protection as required. Special nozzles and gas cups are available to reduce this problem. Most filler metals suitable for alternating current (AC) may be used with direct current (DC) as well, however, stricter requirements for weld metal quality are increasingly being demanded. Special (DC-specification) Cr-Mo filler metals need to be used for quality requirement. This is because the polarity of welding current affects the chemical composition (C, Si, Mn, and Mo in particular) thus the mechanical properties of the weld metal. A popular filler wire from Kobe, TGS-1CM, is classified as ER80S-G because of its unique chemical composition. TGS-1CM weld metal contains comparitively low carbon, phosphorus and sulphur along with a higher manganese content. This improves better fluidity of molten

metal and resistance to hot-cracking that is likely to occur in root-pass welding of pipes.

C	Si	Mn	P	S	Cr	Mo
0.06	0.50	0.99	0.007	0.005	1.22	0.54

Table 3: Typical chemical composition-TG-S1CM

Although, TGS-1CML is the same as that of TGS-1CM, i.e. ER80S-G, however, its welding performance is quite different. First, as to the chemical composition, the lower carbon content of 0.02 (0.06 in TGS-1CM), is effective to prevent hot cracking. Second, the lower tensile strength or lower hardness – hence higher ductility, is suitable for welds to be left in the as-welded condition or when more moderate postweld heat treatment (PWHT) of lower temper parameter is applied. The tensile properties and hardness of the weld metal is a function of the temper parameter.

KOBE Steel Japan, through based on their experience, have developed a range of welding consumables, in addition to the AWS variety, especially for oil refinery reactor vessels and heat exchangers. They have unique characteristics as highlighted below in this referred article.

Electrodes	GMAW Wires	GTAW Wires
CM-A96	MGS-1CM	TGS-1CM
CM-B98	MGS-1CML	TGS-1CML
CM-A96MBD		

Table 4: Special Kobelco Brands for Welding of 1 ¼% Cr-1/2% Mo
They have characteristics as highlighted in the article

SUGGESTED TIPS FOR WELDING BY GTAW

- Direct Current with electrode negative polarity is recommended
- Pure argon gas is suitable for both torch shielding and back shielding with a flow rate of 10-15 litre/minute. A windscreen should be used, where ambient wind of more than 1m/sec,, to protect molten pool from oxidation and poor reverse bead formation
- In automatic GTAW, the welding procedure and parameters should be determined in advance, according to weld quality.
- Preheating and interpass temperature should be 150-200*C to decrease the cooling speed and thereby minimize hardness of the weld and prevent cold cracking.
- Postweld treatment temperature should be 650-700*C to remove residual stresses, decrease hardness of the weld and improve the mechanical properties
- The following techniques may be adopted to prevent imperfections in root-pass welding:
  - Weld crater should be terminated on the groove face to prevent hot cracks in the crater
  - Use proper torch placement and oscillation for making good penetration

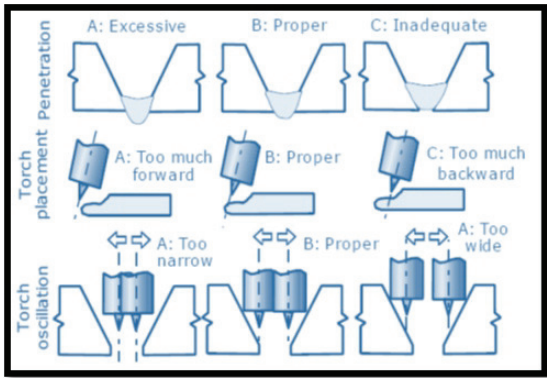


Fig: Proper Torch placement and oscillation for making good penetration

SUMMARY

Significant advancements over the past half-century have made the 1¼ Cr- ½ Mo steels readily weldable. Ongoing research is pushing to increase productivity by enhancing the deposition in AC waveform-controlled SAW welding and FCAW consumables. Material and design improvements are continually pushed by the desire for steel plate structure with larger lifespan. Innovative designs, such as vertical plate coke drum, provide fundamental engineering improvements while quality consumable limit the introduction of detrimental elements. Whatever the future holds, three basic factors must be controlled to produce quality products: hydrogen contamination, temper embrittlement and stress concentrations.

REFERENCE

Kobelco Welding Today-Technical Highlights: Welding of Cr-Mo steels for Power Generation & Petrochemical Applications- Jan Hilkes & Volker Gross (IIW conference Singapore).Adapted from an article by James Brenan and Ben Pletcher – Welding Journal, Vol. 89, No. 4, April 2010.

CR-MO-TRIVIA

Chromoly is stronger than normal steel, weight for weight, and can be drawn with thinner walls. It is commonly used to make high-end bicycle frames, roll cages for race cars, and for fuselages on small aircraft.
AISI 4130 steel with 1 % Chromium and 0.2 % Molybdenum, is an exceptionally tough metal vital to manufacturing, welding, cutting, and other high-stress applications in industry. It has properties better than or like aircraft-grade stainless steels. less expensive and more-easily machined than standard stainless grades, CrMo is also found to be effective in salt-water applications. Some notable applications, other than in heavy fabrication, are manufacturing equipment, vehicle parts, and gears; rock crushing machinery; resistance welding products ; drill bits and taps; mills and cutters etc. Other common examples of equipment that use chrome moly include crank shafts, moulds, chain links, machine shafts, bicycle tubing, drill collars and conveyors.

WELD PURGING FOR P91 STEEL

Some engineering alloys are prone to cracking during welding. Industry sectors having to overcome this problem are principally in power engineering and nuclear and include low and medium alloy steels that have been specially developed for their high strength. Metallurgists have learned that heating the joint prior to and after welding (pre-heating and post-heating) can reduce the sensitivity to cracking quite significantly. It involves temperatures in the region of 200°C although this may be much higher for certain materials.

An example of a commonly used alloy benefitting from this treatment is SA 213 T91 or SA 335 P91. This is a ferritic alloy steel that meets the condition of creep resistance required in high temperature steam generating plant. The material, often simply referred to as P91, has been in successful use for the last two decades in power plant service.

Grade	C	MN	P,S, Max	S	Cr	Mo
P91	0.08-0.12	0.30-0.60	0.020/ 0.010	0.20-0.50	8.00-9.50	0.85-1.05
	V 0.18 - 0.25	N 0.03 -0.07	Ni 0.40 max	Al 0.02 max	Nb 0.06 -0.10	Ti 0.01 max

Welding is one process that is widely used during manufacture. This affects the microstructure.

Preheating, maintaining inter-pass temperatures and post-weld heat treatment procedures are very critical for P91 and similar alloys. Failure to follow the procedures can result in catastrophic failures in service.

Other high temperature creep resistant ferrous alloys.

ASTM A389 grade C24, A 356 grade 9, DIN 21CrMoV 5-11; 15CrMoV 5-10

GS-17CrMoV 511; EN G17CrMoV5-10 and GE B50A224

The preferred welding procedures in this type of fabrication are GTAW and GMAW and these offer protection of the exposed upper fusion zone. The joint around the underbead however needs to be protected by separate inert gas coverage and this is referred to as weld purging. It involves removes of oxygen from the vicinity of the joint to prevent contamination during the thermal cycle.

Meeting the requirements of inert gas purging when temperatures exceeding 200°C are involved necessitates the use of purge systems capable of withstanding these temperatures throughout the heating and welding cycles. Typical thermal cycles can exceed 2 hours and it may be necessary to maintain the purge system in place throughout.

Specially engineered purge products have been designed over the past five years that are capable of withstanding the temperatures involved whilst at the same time maintaining adequate gas sealing characteristics. They are also rugged enough to survive multiple-use applications.

The only manufacturer that has studied materials and designed products suitable for use in weld purging at the high temperatures prevailing during pre-and post-heating is Huntingdon Fusion Techniques, HFT®. These systems, referred to as Argweld® HotPurge™ meet the requirement for thermal stability and operational reliability.

The inflatable seals at each end of HotPurge™ Systems are manufactured from flexible, thermally resistant engineering materials. The connecting collar is fabricated from high temperature resistant material. Gas delivery hoses are manufactured from engineering grade nylon and metal fittings comply with international standards.

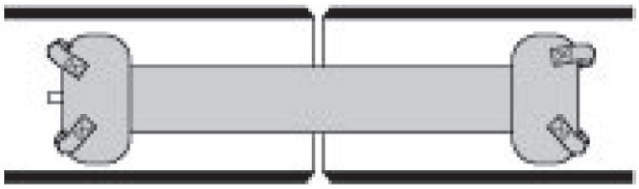
As with all HFT® products. HotPurge™ is subject to continuous development and the latest innovative change has been to incorporate PurgeGate®. This exploits advanced valve technology to ensure that there is no possibility of over-inflation and hence failure of the seals. These heat resistant pipe purge systems are capable of withstanding temperatures up to 300°C (570°F) for 24 hours.

A wide range of piper diameters can be accommodated with HotPurge™ offering sizes from 150-2240 mm (6 to 96 in). All products have an expansion range of +/- 12 mm on diameter.

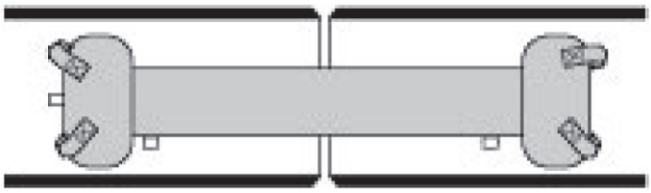
The collapsed system is inserted into the pipe to be welded and positioned at the joint: pull loops are integrated with the system to help with this operation. When the selected purge gas is admitted the dams will first inflate to a preset pressure at which point the gas will be diverted into the purge volume. Gas flow will continue until the weld has been completed and cooled.

- The Argweld HotPurge™ is positioned using the heat-resistant pull tags. A high visibility strip called RootGlo®, is

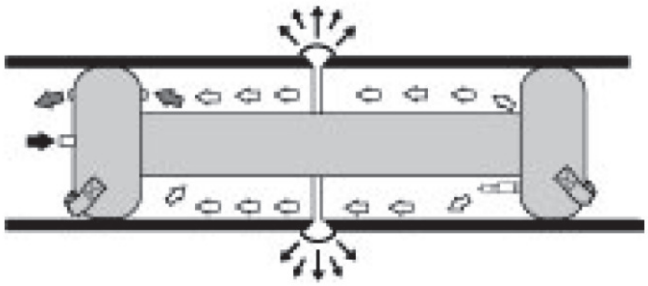
incorporated at the centre to facilitate accurate positioning below the joint under low light level conditions. RootGlo® gives up to 20 hours illumination for only 10 minutes of exposure to daylight.



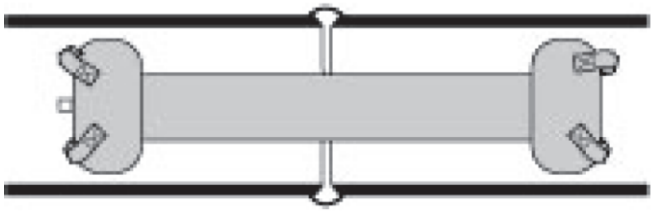
- The seals are inflated using the inert gas supply.



- When inflation is complete the purge valve opens automatically. The inert gas then displaces the air between the seals.



- When the weld is completed and allowed to cool sufficiently to satisfy the metallurgical requirements set by the welding procedure the purge gas can be closed. After disconnection of the hose, the system deflates and is ready for removal.



MEASUEMENT OF OXYGEN LEVELS IN THE PURGE VOLUME

It is of course essenial to confirm that the oxygen coontent at the weld area has been reduced to the level set by the welding procedure. Acceptable oxygen levels may well be below those measurable with older instruments and HFT has developed advanced monitoring instruments specifically for welding operations.

The PurgeEye 100 Ip65 Sealed Weld Purge Monitor has been designed to measure oxygen content as low as 0.01% accurately. For ferritic creep resistant materials an oxygen content below 0.1% is normally considered suitable.

REFERENCE

BS EN ISO 13916:1997 Welding: Guidance on the measurement of preheating temperature, British Standards Institution, 1997.

BS EN 1011-2:2001: 'Welding: Recommendations for welding of metallic materials. Arc welding of ferritic steels', British Standards Institution, 2001

Bailey, N Weldability of Ferritic Steels. The Welding Institute 1995.

Fig 3 – Gr 91 header repair showing weld, purge and preheat set up

SIMPLE TIPS TO EFFICIENCY IMPROVEMENT IN WELDING

Who does not want to improve efficiency in performance – be the factory manager or the welder himself?

INTRODUCTION

The integrity of a weld is extremely important and productivity in welding matters. All welders do not achieve the proficiency or productivity of a full time certified welder. Welding with the wrong machine or technique eats up valuable time. Poor welds cause parts to fail or require a redo. And welding safety needs to be a lifelong learning experience. Besides, cleanliness and taking proper care of welding consumables, the following are some simple ways which can help to increase welder efficiency and at the same time make jobs easier.

- **Provide Adequate Fixtures :**
  Set up time (fitting/tacking) can sometimes take over 50% of the time spent by a welder. Many welders that do repetitive work end up creating their own fixtures to make common weld joints easier and faster to weld. It is typical that when a fabricator buys a robot, fixturing becomes very important and a great deal of money is spent in this area. They get great tooling so that the robot can spend time doing what they are designed for, for example welding. It only makes sense that we should to this for our manual welders as well.

- **Keep Equipment in Good Condition:**
  Faulty equipment, even equipment that only has "hiccups" from time to time can create a lot of problems that cause the welder to stop welding. Voltage drops due to undersized cables, loose connections or frayed cables may produce large amounts of spatter which require grinding time. These issues can also cause an erratic arc which decreases the life of contact tips, diffusers and nozzles. Increasing changeover occurrences of these parts takes away from welding time. Keep equipment in good working condition and see efficiencies increase.

- **Develop Welding Procedures :**
  Providing welders with adequate instructions on what parameters to use on different joints and material types is essential. Even the best welders will spend a lot of time fine tuning a procedure when parts, thicknesses, or positions change. A written welding procedure allows the welder to set his or her machine based on the values set on the welding procedure specification and proceed, thus eliminating time with trial and error.

- **Train your welders and welding operators:**
  It is important for welders and welding operators (operators of robots and fixed automation) to understand what effect the many welding variables have on the weldment. By knowing what happens if you increase or decrease amperage, voltage, travel speed, work angles, contact tip to work distance (in GMAW and FCAW), welders can more easily and quickly troubleshoot bad welds, make the necessary adjustments and get back to welding.

- **Consider the quality of your materials and evaluate alternatives :**
  There is a reason why some fabricators will pay a premium for certain consumables. There are certain applications that cannot tolerate any kind of variability such as wire flip or changes in wire diameter that affect amperage. A wire that may be OK for welding dumpsters may not be adequate for high-speed robotic welding. If your welders or your robots are having issues with wire tangling, clogging liners excessively, missing the joint (robots) and excessive tip usage consider evaluating alternative consumables. This concept is also true for other inputs such as welding guns, contact tips, nozzles, etc.

- **Improve your fit-up :**
  When parts don't fit well the assumption is that the welder will fix it. He or she can simply add more weld metal and everything will be great. This is only partly true. While welders can definitely make some magic happen, this problem can cause significant increases in cost due to reduced efficiencies. It also may cause a violation of welding procedures if the joint tolerances are exceeded.

- **Consider a different Welding Process :**
  Are you using a welding process that produces slag such as SMAW (stick) or FCAW (flux-core)? Is it necessary? We visit many facilities that use flux-cored wire because that's what they have always used. Or because they do some out-of-position welding and don't want to mess with having different wires to do their flat welds which in many cases comprise over 80% of their total welding. Electrode efficiencies of slag producing processes such as SMAW and FCAW are low compared to solid electrodes used in the GMAW process. On top of that you have slag clean-up which adds a lot of time

- **Consider the use of manipulating equipment :**
  This may be what allows you to get rid of slag producing welding processes used for welding out-of-position. If you can weld in the flat and horizontal positions, then you can get by with using GMAW exclusively. A manipulator may cost considerably, but the increase in productivity may pay for the investment in a relatively short amount of time.

- **Conclusion :**
  Having said the above possible ways to improve performance of welder or welding operators it is the responsibility of the manager or the owner of the unit to provide for the facility and to ensure the same are followed, at least till the time the welder or the welding operators get used to these simple and effective ways of working.

  Lastly, it is important to compare and investigate at all levels, the cause of overwelding, which may not only affect strength but also incur avoidable costs.

Orangebeak Technologies Pvt. Ltd. organised a seminar and concurrent exhibition "Boiler India 2020". It was held between 21st. to 23rd.February 2020 at CIDCO Convention Centre, Navi Mumbai. The three days event witnessed 4600+ delegates for the 24 knowledge sessions especially curated and conducted by the Directorate of Steam Boilers, Maharashtra State to celebrate 150 years of Boiler Inspection in India.

The inaugural session was chaired by Shri Dilip Walse Patil, H'ble Labour Minister of Maharashtra State in the august presence of Shri Rajesh Kumar- Principal Secretary, Labour Dept.; Dr. Mahendra Kalyankar- Labour Commissioner and Director, Directorate of Industrial Safety and Health; Shri T.S.G. Narayannen- Technical Adviser(Boiler); Dr Shrikant L. Pulkundwar- Deputy Secretary To Govt., Govt of Maharashtra ; Shri Shashank Madhav Sathe- Deputy Secretary, Govt of Maharashtra; Shri Ramrao Sonu Nandris- Director, Sitson India Limited and Boiler Association of India; Shri Dhawal Antapurkar- Director, DSB, Maharashtra, Mr M.S Unnikrishnan- Managing Director & CEO, Thermax; Mr Vivek Bhatia- Managing Director and Chief Executive Officer, Thyssenkrupp Industries India and Mr Bhanu Rajagopalan- Director, Orangebeak Technologies Pvt Ltd., Nagpur.

The Sessions were divided equally for Boiler Manufacturers and Boiler Users. A special session was conducted for Skill Development. Professionals from all walks of the boiler industry participated to learn and advance technologically.

The wide array of topics discussed included: Success of Modularisation in Boiler Manufacturing.; Modern new trends of Super Critical Boilers, Pressure vessels & Heat Exchangers; Instrumentation, Control, Latest sensing & Performance Monitoring. Use of Additive Mfg. in Boiler & Pressure Vessel Industry, Futuristic Boiler operation. Opportunities in using Agrowaste and Municipal water as a fuel; Use of Solar Thermal Energy in Boilers etc.

Speakers included highly qualified engineers from Thermax Ltd.; L&T MHPS; Forbes Marshall; Thermodyne Technologies; and professionals Mr. Ladum Poulsen from Denmark and Mr.Reimer Spriesterbach, Lloyd's Register EMMEA, among others.

The concurrently held exhibition attracted keen participation from leading players in the boiler and associated industries. Over a span of 3 days it witnessed 220+ exhibitors showcasing their products and services to over 10000 visitors from across the world. For exhibitors, the event offered a good platform to showcase their products and technologies and meet & greet the industry customers.

The prominent exhibitors displayed its capabilities and offerings of range of utility solutions right from energy generation to dissipation; heating and cooling equipment, turnkey power plants, waste heat recovery units, systems for water and wastewater management including wastewater recycle, air pollution control and performance improving chemicals with a focus on sustainable offerings.

Highlights of the display comprised models of various designs such as Shellmax Global Boiler, with international standards; biomass-based heating solutions; in-place sewage treatment and other water treatment solutions; efficient steam accessories and a range of chemicals for special applications.

Boiler and allied equipment manufacturers such as Thermax, Adani Power, Tata Power, Forbes Marshall, ISGEC, Thyssen Group, Alfa Boilers were some of the prominent to showcase their goods, wares, and services to a plethora of industrial and institutional buyers particularly across India and largely across Asia.

Apart from physical exhibits, a series of captivating visual displays were showcased; IoT solutions for boilers and chillers as a game-changer and simulated working of high technology products. A clear trend towards efficiency improvement and sustainability was visible in the industry.

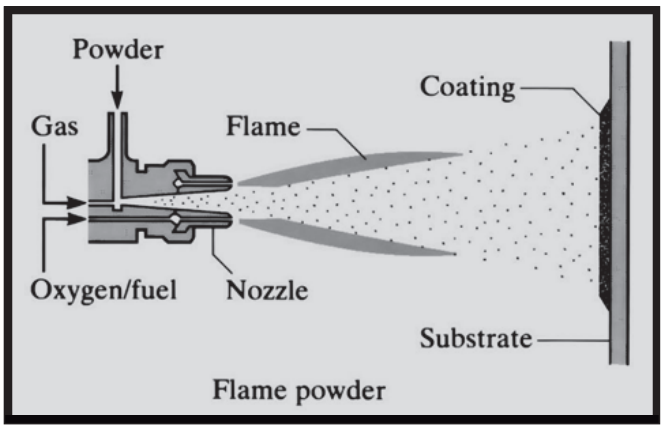
Thermal Spray refers to a group of coating techniques whereby droplets of molten or partially molten material are sprayed on to a solid substrate to develop the coating. Based on the applied heat source and the process characteristics, a large number of thermal spray techniques are commercially available enabling a wide range of material ranging from metal to polymer including ceramics, cermets and carbides which can be used as coating material. The coating develops resistant to various wear factors affecting the substrate.

Thermal Spray has revolutionized the design of machine in practically all the industry. The technology has not only brought down the cost of machine development but has also enhanced the working life of many critical machine parts detrimental to machine performance and overall viability of the process. The small droplet of metal created a ripple effect which led and augmented development of many 'state of the art' processes influencing our lives from travelling in an aircraft to going to a dentist for an implant.

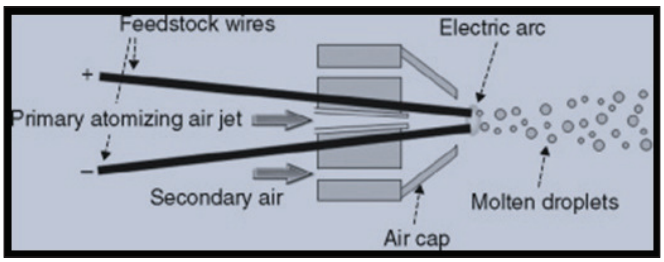
The way thermal spray technology is influencing our machine design and lifestyle, it becomes very interesting to know how and why this process is developed and how it is enriching itself.

Before we go to the chronology of development, let us look at what exactly a thermal spray process is:

The two schematic diagrams given below show typical thermal spray process by using powder feedstock and wire::



Diag. 1 Thermal Spray Coating using powder



Diag. 2 Thermal Spray Coating using wire

From these two diagrams, it is clear that the major variables for a thermal spray process are:

- Material Feedstock, which can be powder or wire.
- Heat Source, which can depend upon the process
- Melting and acceleration of particle, which also depends on the process adopted.
- Impact of molten or partially molten particle with the substrate primarily depends on the travel speed and acceleration of the particle.
- Formation of bond or interlocking with the substrate

In most of the thermal spray processes the basic bonding mechanism is mechanical interlocking except some of the processes like Spray/Fuse and Plasma Transferred Arc where the bonding is metallurgical because of the sufficient heating of the substrate.

As we see from the process and the variables, the bonding between splats can be improved to the desired requirement by increasing temperature or particle impact velocity. However, a very high increase in temperature while coating with metallic or composite feedstock is not preferred to avoid oxidation.

The thermal spray process is now so advanced that it can spray even difficult to melt material like ceramics and carbides and achieve a coating of thickness as low as few microns without heating the substrate. Because of these unique features, the process finds great application in machine component designing, reclamation of worn out components and the highly advanced manufacturing processes like additive manufacturing and medical implants.

Development of thermal spray process is like any other development driven by the quest for improvement and built slowly over the years. The credit of development is shared between two material scientists. Oerlikon was the first person who melted lead and sprayed on a substrate. This was a patented process and so remained confined to a close set of people.

The liberalization and democratization of thermal spray started happening from 1908 when Max Ulrich Schoop used flame spray process to spray pure metal, in form of wire, was melted and sprayed at a high speed on substrate using compressed air. This produced a coating of low bond strength and high porosity. Thought it still had a long way to go but this experimental gave the direction to material scientists and engineers for further research and develop thermal spray as a robust technology to change the surface properties to economize on the selection of the base material for machine components and still get an enhanced working life and also to reclaim the worn out components.

Max Schoop's experiment started a revolution in material science and led the foundation for research and trials in using different material and alloys to get different surface properties. The question comes here why this development was needed. The industrial revolution was taking place and post-world war

one, the machine development was getting momentum. Material scientists were busy and engaged in finding the best material and solution to enhance the working life of machine by extending the mean life before failure of major components.

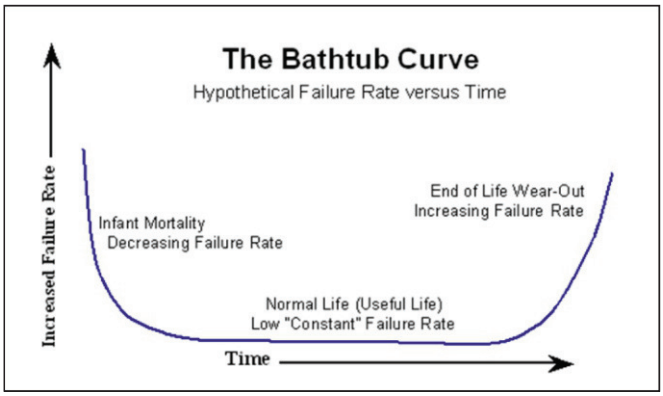


Fig. 1 Typical life cycle curve

This (Fig. 1) is a typical life cycle of any machine part. The initial failures are generally attributed to design issues or misalignment with other components. Once these issues are addressed, machine performs and reaches the end of its life mainly on account of different kind of industrial wear acting on the various components which causes loss of material from surface of machine components, cracks or breakage and make the machine inoperative or slows down the operation. To economize the machine building and enhance life of the machine, the importance of study of industrial wear was realized to select the most appropriate and optimum material which can resist the wear and enhance the working life. The wear factors identified were:
Impact, Abrasion, Friction, Erosion, Cavitation, Corrosion and Heat.

Each type of wear identified affects the machine parts in different way. Impact and abrasion act with certain angle of impingement which result in either heavy loss of material from the surface, cracks, or breakage.

The other five wears friction, erosion, cavitation, corrosion and heat causes damage mainly to the surface and reduces the life span of the machine.

The other five wears friction, erosion, cavitation, corrosion and heat causes damage mainly to the surface and reduces the life span of the machine.

The development so far made was based on the feedstock of molten metal and wire. These had their own limitations like huge constraint in melting or making wire with metals and alloys having high hardness, melting temperature and oxidation in addition to the deposit porosity and adhesion. Each of these limitations created a huge challenge in the acceptance of thermal spray process by the industry. Every wear factor need different surface properties like low coefficient of friction, adhesion, porosity free deposits, resistant to corrosive media and high macro and micro hardness of the coating depending on the wear or the combination of wears acting on the machine parts. Such coating could only be possible with the development of powder feedstock using atomization (Fig. 2):

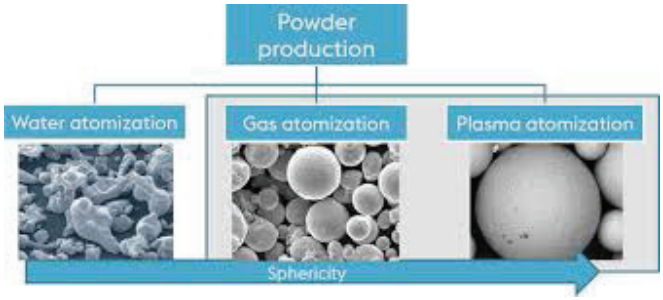


Fig. 2 Types of Automisation Process

Atomisation process was a landmark development which emerged as a turning point in the success of thermal spray as a solution provider not only in economizing the design of machine components but also to enhance working life by providing a superior surface coating which could match the friction coefficient of nickel or as hard as deposit of tungsten carbide, minimizing the deposit porosity to second decimal and resistance to high and very high working temperature. It was now possible to make feedstock of any material even as hard as tungsten carbide and ceramics and melt any metal to make coating feedstock. The limitations with wire as feedstock were overcome.

The development of powder feedstock made possible a deposit having thickness as low as few microns and the advancement made in spray processes can do coating with practically no heat affected zone at substrate. For most of the processes the substrate temperature does not go beyond 200 degrees Celsius which means the base material temperature hardly attains the temperature which can develop heat affected zone while cooling.

Thanks to the development of powder feedstock and atomization process, the industry has today a wide range of thermal powder made of metal, alloys, carbides, ceramics, cermet and even polymer which can provide coating on any component whether it is conventional machine part, moulds, steel mill rolls, gas turbine, industrial valves or equipment as sophisticated as aircraft turbines and also widely used in additive manufacturing for development of medical implants and other critical components.

Thermal Spray is considered today as one of the most potent and effective solutions to protect any metal parts from decay by industrial wear and is also playing a very significant role in economizing the cost of machines by selecting economical material and enriching the surface by thermal powders.

Fig. 3 One of the regular machine components coated with thermal spray powders

The other feedstock which is also extensively used for some of the voluminous jobs is wire made of metal and alloying elements which can be drawn to wire for providing coating mainly for resisting corrosion and also friction, sometimes used also for comparatively smaller jobs. The development of powder feedstock has also made possible manufacturing of flux cored wire giving hard deposit for providing coating resistant to erosion encountered in applications like boiler tubes, industrial fan blades etc. The spray process used is arc spray commercially known as metallizing. Some of the big jobs recently coated by Indian industry using arc spray processes are oil & gas platforms (Fig. 4) for providing coating resistant to sea water corrosion and columns of bridges.

Fig. 4 Oil and Gas Platforms

The progress made in the development of powder feedstock led to the development of spraying processes around the core objectives of minimizing porosities, high deposition rate, ability to spray a wide range of material and minimizing the heat output on the substrate. The industry today has a process which does not even melt the powder and still makes very cohesive bond with the substrate without any application of heat known as Cold Process. The other major advantage one gets from this process is no oxidation of the coating material.

The chronological order of the development of spray processes can be noted as follow:

- Arc Spray
- Spray and Fuse
- Flame Spray
- Plasma Spray
- Plasma Transferred Arc
- High Velocity Oxy Fuel
- Laser Cladding
- Cold Spray

Arc Spray uses wire as consumables, rest of the processes use thermal spray powders.

The selection of spray process largely depends on the kind of coating required for getting certain surface properties depending on the wear or combination of wears the surface is subjected to.

Other than Spray & Fuse and PTA, the substrate is not exposed to any direct heat that makes thermal spray process a great asset to industry in combating wear.

For additional details and availability of consumables, enquiries can be sent to: Mr. Sanjay Sahay on sanjay.sahay@weldwell.com.

NEWS FROM INDUSTRY

- Due to the 'Make in India' initiative, India has figured in the list of global arms exporters for the first time. The import has also reduced by 32% over last 5 years. India has a target to increase its defence exports to $ 5 billion within five years. This will give ample opportunity to indigenise military equipment
- A proud moment for Indian Engineers. Dr. Mahantesh Hiremath has been elected as the President of ASME . He is the first Indian in 139 years, to head such a prestigious professional body. The American Society of Mechanical Engineers, is 11,000 members strong spread over 150 countries
- Leading French jet engine manufacturer Safran has said that it is ready to transfer the full technology for the engines that can power next generation fighter jets and has initiated talks on the matter as it is committed to staying in India for the long term.
- L&T MBDA Missile Systems (LTMMSL) has set up a missile (inert) integration facility at Coimbatore. LTMMSL is a joint venture between L&T and the European defence company MBDA. The company has set up the assembly line for inert integration (without explosives), testing the Missile Subsystems and weapon launch systems.
- Engineering solutions provider Thermax Ltd has bagged ₹431 crore order from a public-private joint venture power company for setting up two flue gas desulphurisation (FGD) systems at their thermal power plant in Jharkhand
- Indian Space Research Organisation (ISRO) is preparing to launch GISAT-1, a new earth observation satellite. GISAT-1 — Geo Imaging Satellite — will be the first of two planned Indian EO spacecraft to be placed in a geostationary orbit of around 36,000 km. It will always be in a fixed spot looking over the Indian continent.
- Mr Dilip Oommen, CEO, Arcelor Mittal Nippon Steel India (AM/NS India) has taken over as President of the Indian Steel Association (ISA). He was unanimously appointed to the position for the next two years.
- ArcelorMittal Nippon Steel India (AM/NS) has acquired the Bhander Power plant in Hazira, Gujarat from Edelweiss Asset Reconstruction Company. This follows the declaration of ArcelorMittal India as a preferred bidder for Thakurani iron ore mine in Odisha. Bhander, a natural gas-based thermal plant with an installed capacity of 500MW, will remain captive to AM/NS India's steel manufacturing operations at Hazira.
- Sandvik is right now supporting the fight against the coronavirus by supplying precision wire to ventilator manufacturers. The precision wire manufacturer factory in Palm Coast, Florida is extremely busy and works double shifts to produce the EXERA® medical wire which are used in ventilators. The need for more ventilators is huge in the coronavirus pandemic.
- Sandvik recently upgraded the cold forming capabilities at their Mehsana steel mill in India, boosting capacity and rounding out the facility's corrosion-resistant tube offerings. Specifically, a new manufacturing line focused on heat exchanger tubing has doubled cold-working capacity, allowing for swifter delivery times across the Asia-Pacific region.
- Kemppi India have signed a Memorandum of Understanding to set up Kemppi Amaljyothi Centre of Welding at Kanjirappali in the state of Kerala. In this way, Amaljyothi College , a renowned college and Kemppi India, the leading welding equipment manufacturers, are jointly promoting the idea of “SKILL DEVELOPMENT” in India. The centre will undertake training welders from different strata of the society. A special program has been developed for girl students.
- Godrej & Boyce Mfg. Co. Ltd. shipped one of the world's tallest Continuous Catalytic Regeneration (CCR) Reactor from Mumbai Port to Dangote Oil Refinery in Nigeria. With its height measuring a gigantic 95 metres, the CCR Reactor is 22 metres taller than the Qutub Minar and weighs approximately 703 tonnes, nine times heavier than a space shuttle. CCR is the key process in oil refinery converting low value naphtha to high value products such as petrochemicals and gasoline through various reactions such as dehydrogenation, aromatisation, isomerisation, dealkylation, dehydrocyclization.
- The Drone Federation of India (DFI) announced a tie up on Monday with Amazon Web Services (AWS) to drive innovation in India's drone ecosystem. To manufacture and sell drones, Indian state-owned aerospace, and defence company Hindustan Aeronautics Limited (HAL) has signed a Memorandum of Understanding (MoU) with Bengaluru based Dynamatic Technologies Limited (DTL) and Israel Aerospace Industries Limited (IAI) at DefExpo 2020.
- SpaceX is building a new re-launchable Starship that will be capable of carrying one-hundred passengers plus tons of cargo, during long-duration voyages to the Moon and Mars. The plan is to re-launch within few hours of landing both up and down almost continuously.

  SpaceX initially aimed to use carbon-fiber for building of Starship, however they opted for stainless steel. They built its first few Starship prototypes out of a stainless-steel alloy known as 301, a blend commonly ussed by aerospace engineers. To meet the new exacting demands SpaceX engineers are now designing a new Stainless Steel for their purpose. This may be what allows you to get rid of slag.

  The Engineering Council of India presented L&T Group Chairman Mr. A.M. Naik the 'Eminent Engineer Award - 2019' at a function in New Delhi. The Council is the apex body of engineering associations in the country and recognizes extraordinary service by the most eminent professionals in the country.

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Address: 401, Vikas Commercial Centre, Dr. C. Gidwani Road,
Chembur, Mumbai - 400 074
Tel.: +91 22 66462000 / 25205523 Fax : +91 22 25206789
Email : sales@weldwell.com, nivek@weldwell.com
Branches : Baroda · ·Pune · ·Surat