Welding Technology in India

By Dr. M.N. Dastur*

.I consider it a privilege to address the welding technologists on the occasion of their annual seminar on "Welding in Steel Plants", especially today when the Indian Institute of Welding is celebrating its twentyfive years of service to the industry.

Welding technology has progressed enormously over the past several decades. After the Second World War, the industrialised nations realised that welding will play an important role in the manufacture of plant and equipment for diverse service requirements. Simultaneously, there have been many developments in the field of metals and alloys. Newer and more sophisticated metals and their alloys have emerged, joining of which pose problems. For example, many such alloys have specific properties - some are meant for work at high temperatures over a prolonged period while others need to function at sub-zero temperatures. Again, reactive metals and alloys such as of titanium or zirconium which are used in the manufacture of aircraft, rockets, long-range missiles etc., also require extra special care during joining. Low alloy and high alloy steels of a wide variety have been developed and some of these are available as forged, others in rolled or cast form. Each of these metals and alloys require special care.

For non-ferrous metals and alloys - alloys - aluminium, copper etc. - an altogether different approach is required during joining. Some of these alloys are heat treatable while others are not. A few are precipitation hardened while others are case hardened. Without full knowledge of material properties, welding of such materials can prove to be catastrophic. An experienced welding technologist has to consider all aspects of material properties such as tensile, elongation, hardness, impact, fracture toughness as well as other properties before the welding procedure is finalised. As you are aware, in the case of specialised service requirement, welding procedure test has to be separately carried out on specimens simulating service conditions. Only after the welding procedure test satisfies the requirements of Codes, shop floors are allowed to start fabrication as per the "qualified" procedure.

A wide variety of new welding processes have been developed in the past few years. Basically, welding processes are divided into two categories - fusion and solid phase welding. In the former category, most of our known welding processes such as Manual Metal Arc (MMA), Metal Inert Gas (MIG), Tungsten Inert Gas (TIG), Submerged Arc Welding (SAW), Electro Slag Welding (ESW), Electron Beam Welding (EBW) are included. There is a separate group of welding processes consisting of spot, seam and projection welding, which is still a part of fusion welding. In the case of solid phase welding, processes like diffusion bonding, friction welding, cold butt welding, hot welding etc. are prevalent. The advantage of solid phase welding is that the material is joined without heating to the liquid phase. As a result, the metallurgical properties are expected to remain the same after welding for the metal and alloys that are being joined. Such processes are suitable for joining dissimilar metals as well as difficult-to-weld metals and alloys.

Besides welding, joining processes like brazing and soldering are also prevalent. In brazing, both base metals and filler wires are melted while soldering uses melting of filler metals only between two interfaces.

In India, Manual Metal Arc Welding (MMA) is being used in about 85-90 per cent of welding applications. Of late, processes like MIG with solid wire as well as flux-cored wire have been introduced, using semi-automatic and automatic machines, but the applications are still limited. The use of Submerged Arc Welding (SAW) for joints in pressure vessels, heat exchangers and crane girders is popular.

A wide variety of Manual Metal Arc Welding electrodes are being manufactured in the country with or without foreign know-how. Solid and flux-cored wires, fluxes (basic and agglomerated) are available from local sources. Welding equipment like welding transformers, rectifiers, generators (power/diesel driven), welding aids (such as booms, positioners and rollers), wire feeders, flux recovery units etc. are locally manufactured.

Except for a few specialised applications such as pressure vessels, heat exchangers, ship-building, off-shore platforms, nuclear vessels and similar critical areas, the quality of welding is not being monitored in our workshops as it should be. As a consequence, defects in welded joints, distortions etc. take place and make the fabricated items unsuitable for use. Repair/rectification of such items without proper care makes the situation worse since such repairs may increase the volume and variety of defects rather than control and eliminate them.

Welding is used in almost all industrial applications. For example, heavy and light structures, ship-building, fabrication of off-shore platforms and rigs, sub-sea pipelines, vessels, equipment for fertilizer and chemical plants, passenger vehicles as well as in the railways - in all welding is essential in a variety of ways. For more sophisticated applications such as nuclear reactors, rocket and missiles, processes and procedures are to be chosen carefully to meet the stringent demand of the specifications and Code.

In the field of steel plant equipment, which is the theme of the seminar, wide application is made of welding. The challenge faced by engineers in the fabrication of the blast furnace shell is one such example. There is hardly any equipment used in a steel plant in which welding does not play a part. A wide variety of welding processes are used in the fabrication of basic oxygen converter with its trunnion rings for the steel melting shop; in the rolling mill equipment such as mill stands; for power plant; and the oxygen plant. Fabrication of heavy steel structures at site utilising a variety of materials such as High Strength Low Alloy Steel (HSLA) also calls for careful welding.

Repair and reclamation is also one of the most important area where welding is applied in steel plants. I understand that quite a few papers on this subject will be presented.

In general, welding in India has not kept pace with recent developments. Our workshops are still using antiquated processes such as oxy-acetylene welding as well as manual metal arc welding in which the productivity is low and the quality is not always the best. Even in sophisticated workshops, one may not come across the use of solid phase welding which gives a very strong and sound joint. In fact, even in the manufacture of complex automobile components, friction welding is not widely used though its importance is undeniable. Diffusion

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bonding is another area in which many reactive metals can be joined without much complication, but it is rarely used. The use of flux-cored welding although having made a start, has not been applied even today. Progress depends on the technologists' realisation that much remains to be done to improve our standard of welding and in choosing the optimum process for each application.
The Indian Institute of Welding has been doing a commendable job for the last 25 years in promoting the science and art of welding in the country. It has been holding training and appreciation courses for our welders, supervisors and engineers. Welding seminars and lectures by experts in their respective fields are being organised. I understand that the Institute is also conducting examinations to qualify students as Associate members, since we do not have regular courses on welding in our Polytechnics, Universities and IITs except for a few Post-Graduate courses. This effort by the Indian Institute of Welding is most commendable. However, simpler training courses in regional languages may be added to train our welders. The Indian Institute of Welding, Calcutta needs to be congratulated for holding such industry-wide seminars for the past few years. I hope that the delegates and participants in today's seminar will be benefited from the deliberations and I wish you great success. □

A Retrospect

By N.K.Sarkar, *Central Council Member*

Twenty second day of April,1966 is a red letter day for all the lovers of Welding technology and its allied subjects in India, as on this day, our Indian Institute of Welding was incorporated as a limited Company under the Company Act, 1956.

There was no National Institute of Welding in India then to foster the technical development of welding. It was therefore essential that such a Technical Association was formed, at the earliest opportunity so that the development of welding could be guided in the proper channel and India can take its rightful part in National as well as International activities in the field of welding.

With this in mind, few members few the earstwhile Indian chapter of the Welding Institute, London met on 5th May, 1960 under the chairmanship of Late Sir L.P.Mishra, the then General Manager of the Hindusthan Motors Ltd., Calcutta at 48/1, Diamond Harbour Road, Calcutta, the then Head Office of the Indian Oxygen Ltd. They agreed to form the Indian Institute of Welding for the purpose of prompting the advancement of science and practice of welding and its allied subjects incidental thereto.
The following are the founder members :

Mr. D.S. Desai	:	M/s M. N. Dastur & Co (P) Ltd.
Mr. M.N. Dastur	:	Calcutta
Mr. P.K. Mallik	:	M/s Burn & Co Ltd., Howrah
Mr. *S. Basu	:	Consulting Naval Architect, Calcutta.
Mr. A.K. Sen		
Mr. J.A. Muliyil		
Mr. V.R. Subramanian	:	Indian Oxygen Ltd., Calcutta.
Mr. *R. Ghosh		
Mr. *K. Hartley		
Mr. S.S. Mukherjee	:	S. E. Rly., Calcutta.
Mr. S. K. Pathak	:	Braithwaite & Co., Calcutta.
Mr. V. Venkatesan		
Mr. B.N. Bhattacharya	:	D. G. S. & Inspection Wing, Calcutta.
Mr. *B. N. Majumdar	:	D. G. S. & D., Calcutta.
Mr. B.N. Banerjee	:	Bridge & Roof co. (India), Calcutta.

* Gentlemen are not alive

Started with modest fifteen members, the Institute now has more than 2500 members throughout the country and abroad. Bangladesh Welding Electrodes Pvt. Ltd., are also our member.
The First meeting of the subscribers (members) was held on 18th May, 1966 at 48/1 Diamond Harbour Road, Calcutta and elected the first Council as under :

President	:	Mr. S.K. Datta
Vice President	:	Mr. D.S. Desai Mr. S.S. Mukherjee
Hony. Secretary	:	Mr. S. Basu
Hony. Treasurer	:	Mr. V. Venkatesan
Chairman General Purpose Committee	:	Mr. K. Hartley
Members	:	Mr. S. Pathak Mr. P.K Mallik Mr. B.N. Bhattacharya