Adam Wynne Hughes, Managing Director, Pipeline Induction Heat Ltd, discusses multi-component liquid field joint coating systems and the use of automation for application.

Today, significant onshore pipelines are in development to transport hydrocarbon products over many hundreds of kilometres and, globally, across many continents. With an increased emphasis on initial pipeline integrity, the requirements for commissioning the line as quickly as possible, and for pipeline construction methodology and techniques, have become an integral part of planning and implementation.

The use of automated equipment and processes offers highly repeatable, faster installation times, whilst maintaining high standards of quality. This article looks at one of the key activities in pipeline construction: application of external field joint coating systems using automated equipment, as offered by CRC-Evans, Pipeline Induction Heat (PIH). PIH supports the newly developed global channels of CRC-Evans.
Coating and welding large diameter onshore pipelines

Large diameter, onshore pipelines involve the use of factory coated line pipes. Factory coating specifications often refer to the use of three-layer polyethylene (3LPE) or fusion bonded epoxy (FBE).

The line pipes are welded along the right-of-way (ROW) where automatic welding equipment is widely used for large diameter, onshore pipelines.

Following the welding activities, the field joint area will require protection from corrosion. External field joint coating systems are selected in accordance with the design criteria and applied to the welded joint area, providing corrosion protection throughout the operating life of the pipeline.

It is important that the selected external field joint coating system is compatible with the external line pipe coating system. Typical systems include heat shrink sleeves, cold applied tapes, field applied FBE and multi-component liquid (MCL) coatings.

Multi-component liquid (MCL) coating systems

MCL coating systems are increasingly used for large diameter pipelines. Two generic types are available: epoxy and polyurethane. Generally speaking, MCL epoxy tends to be used with FBE coated line pipes and MCL polyurethane used with 3LPE coated line pipes.

The MCL coating systems consists of two components; a base and hardener, and when the two components are intimately mixed to the specified ratio, these will cure to form a corrosion resistant layer around the welded area.

Application can be carried out by manual brush, but this is highly labour intensive and relies heavily on the skill and care of the applicators. Products are supplied in kits, which, along with all the brushes and rollers, will later require careful waste disposal, in accordance with legislation.

Manual spray offers increased speed in application, but again relies on the skill and care of the applicator. Control of the applied dry film thickness (dft) is also down to the skill and experience of the applicator and a high degree of overspray is common, presenting a hazard to the environment and health and safety of the applicators and other localised workers.

Eliminating human error

It was clear there was a need to minimise or eliminate the human error element. Long transmission pipelines will involve many tens of thousands of field joints, each requiring protection from corrosion. The field joint coating system must therefore be applied in an equal quality to each and every joint area. In order to address this need, CRC-Evans, PIH designs and manufactures up-to-date equipment and processes for the application of field joint coating systems, utilising automation in order to achieve a high degree of repeatable quality, whilst ensuring speed and efficiency in the application process.
In 1999, PIH developed an automated spray assembly coating frame for the application of MCL field joint coating systems. The coating frame is positioned on the welded joint area and is pre-programmed to rotate around the joint area, in order to achieve the desired dry film thickness (dft).

The coating frame moves evenly around the joint area, applying an even film of the MCL coating. In particular, when using MCL epoxy it is important to keep the applied dry film thickness within the manufacturer’s recommendations, as over-build or over thickness can lead to a reduction in some mechanical and corrosion resistance properties.

The spray head is mounted on the coating frame in a specific position, in order that it is always perpendicular to the substrate, thus, overspray is eliminated, minimising any potential hazard to the environment and the operator.

**Fully Automated Spray System (FAST™)**

The automated spray equipment has been developed further, in order to incorporate online quality control and monitoring of the materials and application conditions during the coating application spraying process. In 2009, CRC-Evans developed the fully automated spray system, FAST™ and is now an integral part of the fleet of automated application equipment.

Currently, PIH has 18 automated coating frames in use on major projects around the world, with further units in manufacture to meet future project commitments.

The coating frames can be used for the application of most MCL coatings. Major manufacturers of MCL field joint materials such as Denso, SPC, TIB and 3M have and are currently supplying materials for application by CRC-Evans, PIH automated spray assemblies.

The spray equipment allows for a very efficient and highly repeatable application process. The typical spread set-up will incorporate blast preparation, followed by induction pre-heat and, finally, by the use of the FAST spray technology.

The system is capable of achieving up to 15 joints per hour, depending on diameter size, from a single spread of equipment and will provide optimum material usage, leading to further cost savings.

Improved features allow for the monitoring of material parameters, along with automatic – and real-time – checking of the pumping equipment to ensure the material is being applied at the correct conditions and in the correct mix ratio at all times. The advent of the online monitoring system assures clients that crucial material, mix ratio, conditions and temperature are always ‘on ratio’ and that all critical parameters are continuously monitored, without the need for human intervention. The system accurately logs time, date, batch numbers and coating material and verifies the correct flushing and loading of lines throughout the application process. The
system also allows users the ability to easily change settings for higher or lower thickness levels, when needed.

In fact, the FAST spray equipment includes a ‘stall check’ feature after every joint application, and will not allow coating to continue if any irregularities are detected. The ‘fail-safe’ alarm and system shutdown features ensure accuracy and quality in every application, while real-time data logging of all relevant parameters ensures complete accountability. All of these combined elements prove the technology’s immeasurable value by significantly reducing the risk for human error, while simultaneously ensuring repeatable quality and the long-term integrity of the coated field joint area.

Use of the spray equipment requires only a minimal number of PIH specialist personnel in attendance. In cases of high daily productivity (high construction rate), for example, those involving automatic welding techniques, the benefits of FAST technology can be fully appreciated.

Meeting the needs of the increasing demands of the pipeline construction industry

Large transmission pipelines are currently under construction in the USA, Canada, Australia and Algeria, where specifications refer to the use of MCL field joint coating systems. The fully automated, pre-programmable CRC-Evans, PIH FAST spray technology is being used to apply the MCL coating, achieving high daily production rates along the ROW, providing fast, consistent and high quality application of the field joint system to every welding area.

CRC-Evans is supported by PIH with the development of innovative field coating solutions, including a number of application systems and procedures that have been designed to meet the changing requirements within the industry, with the emphasis on HSE, production and cost. In addition to these patented fused three-layer PP and PE processes, more recent developments have included IMPP and Neptune for CRC-Evans Offshore, as well as technological advances with various fully automated processes. This level of advancement and innovation consistently meets the ever-increasing demands of the pipeline construction industry to improve productivity, reliability, safety and quality assurance.