TRANSFER OF WELDING SOLUTIONS FROM OFFSHORE TO ONSHORE PIPELINE CONSTRUCTION APPLICATIONS

By Frederic Burgy & Shana Cohen

**Topic:** Pipeline, welding, construction.

**About the authors:**

Frederic Burgy, Projects & Operations Department Manager, EMEA-CIS

Frederic Burgy has more than 12 years of experience in the pipeline welding industry. Frederic holds a Master’s in Materials Engineering with a specialization in Welding, from ISITEM/Polytech Nantes, and now acts as the Projects & Operations Department Manager for Serimax’s EMEA-CIS region. In this role, Frederic heads the department for management and execution of all EMEA-CIS projects (offshore, onshore, spoolbase/multi-jointing and fabrication projects), ensuring operational excellence.

Shana Cohen, Commercial Analyst

As Commercial Analyst, Shana Cohen is responsible for marketing development activities in Serimax’s EMEA-CIS region, with a focus on market research, business and performance analysis. Shana holds an MSc in Marketing & Strategy, as well as a BSc in Management from Warwick Business School in the UK.

**About the speaker:**

Julien Blondeel, AFMED Business Development & Commercial Manager

Julien Blondeel joined Serimax early in 2011, in the position of Business Development and Commercial Manager for the Africa, Europe and Mediterranean area. With a decade of projects and commercial experience in the offshore and onshore pipeline industry, Julien is central to the development of activities for the region. He holds a Master’s in International Business from the University of Lille in France.

**Organisation: SERIMAX**

Serimax, headquarters in Villepinte, France.

A division of the Vallourec Group, premium tubular solutions provider.

Serimax EMEA-CIS Region based in Mitry Mory, France (near Paris).
ABSTRACT

Offshore-driven technology developments in pipeline welding are based on increasingly stringent requirements for weld quality given operational constraints and pipeline design. Combined with the essential cost-efficiency factor, and the ability to fulfill all project requirements as per client requirements, the following question arises:

What should welding technology and solutions bring to enhance offshore project performance?

- Repeatable high quality: the ability to ensure weld integrity in all types of welding environments; improved quality leads to lower repair rates and higher productivity;
- High productivity: the ability to weld quickly, driving down overall operational requirements, and therefore, costs;
- Versatility: the ability to weld a large range of different materials (carbon steels, corrosion-resistant alloys) and pipeline dimensions, in different positions and on pipes subject to varying levels of criticity (flowlines, steel catenary risers/fatigue-sensitive lines, offshore offloading lines…).
- Reliability: on the critical path of pipelay operations offshore, welding equipment should fail as seldom as possible in order not to incur a cost premium;
- Customized solutions: the ability to deliver operational support and expertise for seamless project execution.

We use technology case studies to show how Serimax has transferred technology and offshore innovations or project service models to the more unpredictable onshore pipeline construction market, adapting top-of-the-range welding equipment, solutions and project management approach, while overcoming challenges set by onshore pipeline construction.

Examples of innovation transfer include:

- The Serimax in-house developed field-proven Saturnax bug and band welding system was initially designed to achieve repeatable weld quality and high productivity for S-Lay welding offshore; this technology has been adapted to the onshore pipeline market in more recent years, delivering an equipment solution where fewer welding stations and a more compact welding spread can achieve record production levels and high-quality welds;
- For the welding of offshore offloading lines (OOL), it was essential to develop a powerful internal pipe alignment and clamping tool in order to minimize high-low.
This technology was adapted to onshore pipeline welding with the specifically-designed Maxiluc re-rounding pneumatic internal line-up clamp.
- Beyond welding equipment and procedure development, project services and management processes have been developed based on offshore practices.

1. Introduction

Serimax is a welding solutions provider to the pipeline construction industry, delivering the highest standards of welding technology, expertise and project services to international and local contractors worldwide, both on land and at sea.

Initially the automatic welding development branch of a major international offshore contractor, in the mid-2000s, Serimer Dasa (France) was bought over by private funds and merged with Umax (UK) to combine a strong portfolio of equipment and technology solutions, with project services and management expertise. Both companies had served exclusively offshore markets, and from this long history of developing solutions to match the stringent requirements of offshore SURF construction and installation, the merged company was designed and structured to deliver the highest standards in offshore welding performance.

New growth imperatives and market potential for onshore pipeline construction have pushed Serimax into the onshore market, bringing on new challenges to adapt to equally stringent but significantly different market requirements, in often more unpredictable and unprotected environments. Adapting technology solutions and project services, as well as organizational make-up and business model, to ensure success in responding to client and market requirements onshore, has been one of Serimax’s main operational missions for the past decade. The transfer and adaptation of highly-specific offshore welding solutions to the onshore market has proven a successful strategy so far, and continues to be effective in delivering performance with a variety of contractors worldwide, from major Saudi Arabian partner R.H. Al-Marri & Sons Co., to leading Belgian contractor Denys.

Serimax has today been integrated in the Pipe Project Division of the Vallourec Group, looking towards achieving strong business and operational synergies with sister companies, local partners, and our existing and future client network worldwide, through the most challenging pipeline projects.

This paper will firstly set out the major challenges for onshore pipeline welding as perceived by Serimax, from general operational constraints to specific welding engineering issues. Using case studies, we will show the relevance of equipment,
engineering and project service innovations in offshore pipeline welding, for the onshore pipeline construction market, and show how Serimax has achieved success in a dynamic market environment.

2. Delivering welding quality for all applications

In terms of welding quality and, as an extension, production performance, Serimax technology has set industry records, both offshore and onshore. Designed to achieve record levels of productivity offshore with repeatable high-quality for all mainline production welds, the Saturnax dual-torch bug-and-band welding system has performed all of Serimax’s offshore and onshore projects since its introduction in the early 1980s, proving its worth in achieving the following benefits, particularly in demand for offshore production.

As an equipment solution specifically designed for external welding on copper backing, the Saturnax and its associated ancillary equipment (internal clamping tools equipped with a copper shoe, for example), allow the customer to achieve practical use, accessibility to the equipment and weld, field-proven efficiency and full compliance with the most stringent weld quality, as well as Health & Safety standards. Furthermore, this in-house developed, proprietary multi-process welding system enables a higher welding speed and higher deposit rates thanks to its dual-torch welding head, and allows significant cost efficiencies in terms of welding consumables thanks to the narrow-groove bevel used.

Onshore, the assets of the Saturnax system have allowed Serimax to bring an innovative value proposition to the market, from the USA to Russia and the Middle East. Indeed, with its flexibility, the Saturnax system allows onshore pipelay contractors to achieve record productivity rates with a reduced welding spread, lowering overall project costs by cutting personnel and handling requirements.

Initially designed to fulfill all offshore pipelay constraints, this high-productivity welding system, capable of welding all pipe diameters and wall thicknesses (above 7 mm), also ensures industry-leading lay-rates onshore, and has proven its added value for the most operationally demanding landline projects.

Although the GMAW process welding on copper backing has been the most popular welding process for offshore and onshore use, Serimax has also adapted its equipment to a variety of other processes, including the Surface Tension Transfer (STT) process developed and patented by Lincoln Electric.

The STT process (short arc process) uses a reduced energy source, with a constant background current to ensure continuous arc transfer at root, associated with peak
current to control droplets entering the welding pool. This combination of reduced energy and the ability to control the energy delivery through droplet by droplet control of the welding pool penetration means that no copper backing is necessary, and burn-through is limited given adequate welding parameters.

The smooth achievable root profile associated with STT has made the process popular for welding of fatigue-sensitive lines offshore. Serimax, as one of the first-movers in adapting this technology, applied this process offshore as early as 2003 on projects such as Nakika pre-fabrication welds in the USA, or Bonga steel catenary riser (SCR) welds offshore Nigeria.

In some areas, restrictions have been placed on the use of copper backing shoes with external welding systems for onshore pipeline welding. Serimax has therefore adapted the STT process to onshore applications with such requirements, achieving strong performance on medium-to large diameter projects for GRT Gaz (France) and Fluxys (Belgium).

3. Internal clamping equipment

Serimax’s powerful in-house Internal Line-Up Clamps (ILUC) were initially designed to ensure quick and effective fit-up and alignment to guarantee enhanced weld quality, and resulting productivity, in line with stringent requirements set by offshore specifications. This technology set new industry standards offshore, for example on offshore offloading lines (OOLs), steel catenary risers (SCRs), or fatigue-sensitive applications requiring optimum weld quality. As the issue of pipe geometry on large-diameter onshore projects arose, adapting this clamping equipment range to onshore welding gave rise to the Maxiluc internal line-up clamp with re-rounder capabilities.

The Maxiluc internal line-up clamp with re-rounder capabilities is a powerful pneumatic clamping tool designed to achieve higher weld quality through improved pipe geometry. By reducing out-of-roundness of the tubes of diameters from 36 to 56 inches, the Maxiluc ensures that alignment, and therefore, high-low, are optimised. This clamping equipment has proven particularly successful in welding large-diameter pipelines onshore, in any working conditions, whether standard terrain, desert or Arctic environments. Indeed, onshore, issues with pipe quality and geometry may lead to frequent weld repairs and delays in production schedule. Being able to correct this aspect of a project with a single piece of powerful clamping equipment has allowed several landline contractors worldwide to achieve significant economic gains.

As an example, the Maxiluc has achieved great benefits for pipeline contractors on Saudi Aramco projects (56- and 44-inch lines) in the Saudi Arabian desert. In Arctic
conditions, the Maxiluc is currently mobilized on a range of Gazprom projects in Russia (currently welding 40- and 48-inch lines for the BTK gas pipeline and the Pyakyakhinskoye gas field pipeline).

Additional features may be adapted to the range of Serimax ILUCs, including a fully-automated modular, controlled gas-purge unit called Roxane®. This system is used to control oxygen content in the welding shielding gas when welding corrosion-resistant alloys. Also derived from Serimax’s offshore premium technology offering, to ensure optimum weld quality, the Roxane® gas purge equipment is increasingly popular for sour gas, Liquefied Natural Gas, or other corrosion-sensitive onshore pipeline projects of any diameter, which simply reflect industry convergence towards exploration and production of complex hydrocarbons in new frontiers.

Offshore, the Roxane® was mobilized onboard Subsea 7’s Polaris vessel to perform the welding of 12.75- and 16-inch clad-lines (Inconel 625) for the OSO RE Project in Nigerian waters. Onshore, the In Salah Gas consortium (Sonatrach, BP and Statoil) has chosen Serimax to perform the welding of 8.625”, 12.75” and 16” 13% Chromium lines in Algeria, subject to stringent anti-corrosion constraints, using an internal line-up clamp equipped with the Roxane® gas purge unit.

4. Quality control

In the context of the industry convergence towards more complex pipeline projects, combined with long-term pipeline integrity imperatives, quality control standards have become significantly more demanding. More and more emphasis is placed on reporting and control, due to increasingly stringent operator-specified normative systems and pipeline design specifications.

Serimax developed effective quality control systems designed for offshore welding in the early 1990s, in order to satisfy equipment demand for robust reporting of welding parameters. This enabled quality control analysis which was directly integrated into the welding system package.

The latest version of the quality control module developed in-house is the Cleverweld, a complete software suite dedicated to welding production quality control. This software automates and collects several types of quality control data (including pipe and bevel geometry, pre-heat temperatures, back purge cycles, welder ID for every pass, automatic and manual welding measurements, Non-destructive testing inspection reports, weld profile reports, GPS welding joint position, post heat treatment cycles,… and more) before, during and after welding, in order to facilitate reporting and
production analysis. With built-in wi-fi capabilities and an internet connection available on site, direct access to data can be set up anywhere in the world.

Real-time tracking for full production traceability and recording through a single and customizable quality control report has become an essential feature of the Serimax welding equipment portfolio, and has provided significant added-value on all offshore and onshore projects completed thus far.

5. Organization and project process: customer proximity for operational excellence

Serimax’s history as a leading offshore welding company has led to organizational processes, project management methods, and customized project services, aligned with the offshore business model.

With a historical cultural focus on operational excellence for offshore, Serimax has structured its regional organization around achieving the highest operational and technical standards, ensuring customer proximity at every stage of the project, and supported by a standardized “group-level” research and development program, operational methods team, and project resources (including on-site project personnel). A specialized welding engineering and operations team exists in each of the four Serimax regions (EMEA-CIS, Asia Pacific, North & South America, Northern Europe), for pro-activity in defining, and reactivity in solving, technical challenges.

This offshore-centric, customer-focused business model based on customized project and equipment solutions, has proven effective in the onshore market segment, benefiting customers with strong projection capacity in terms of operational support and logistics, as well as close and constant communication with project-specific teams. Furthermore, this customer proximity has led Serimax to develop key partnerships for offshore technology development with both SURF contractors and oil and gas majors. From this experience and reputation, joint research and development programs have recently been launched for onshore applications.

In terms of project processes, we consider the example of spare equipment philosophy. When project scheduling becomes essential for project success following incidents due to the unpredictable external environment (poor weather conditions, for example), avoiding down-time due to equipment breakdown, particularly in harsh environments, becomes critical. In order to ensure strong project performance, offshore project spare equipment and part supply philosophy has been introduced onshore, and
has proven to be highly effective to avoid production down-time, as is the case for offshore production.

6. Conclusion

Although initially designed for offshore applications, most of Serimax’s equipment solutions and organizational make-up have been adjusted to fulfill the equally stringent, but very different, onshore pipeline welding market requirements.

Over the past decades, Serimax has achieved record performance on the most complex offshore welding projects worldwide, a feat which has been transferred onto the onshore market. Whether in highly competitive markets of the Middle East, in the harsh cold operational conditions of Russian winter, or in the complex regulatory context of pipeline construction in Western Europe, major pipeline players have perceived the value-added of robust and versatile welding solutions delivered by Serimax onshore.

Enhanced weld quality, improved equipment spread efficiency and productivity, risk-mitigation based on offshore-centric project processes and strategies, and customer proximity through a focus on service, have all contributed to successful project execution at a global level. The philosophy of a strong portfolio of standard but customizable equipment and project service solutions is a key success factor offshore, and continues to be a competitive advantage in the onshore market.