

P-600 Dual Torch Self Tracking Welding System

The P-600 dual torch welding system was introduced in 2001 since then we have completed 18 projects. The P-600 is unique in that the torches have independent motion control for oscillation and vertical position. In addition, the P-600 system incorporates several technological advances.

First, through the arc tracking technology controls the position of the arc both vertically and horizontally in the weld joint. This makes it possible for the average welder to operate the P-600 with a minimum of effort. It improves weld quality and makes high productivity procedures possible.

Second, the P-600 has position based welding parameters. A digital inclinometer feeds real time position data to the control system. The circumference of the pipe can be divided into multiple sectors. The parameters for each sector can be programmed. They are changed automatically as the P-600 advances around the pipe during a welding cycle. This feature makes it possible to develop and execute high productivity welding procedures.

Third, the P-600 uses the pulsed gas metal arc welding process (PGMAW) rather than the normal short arc (GMAW). The PGMAW process further reduces potential to defects and significantly improves the weld metal toughness properties. This is most beneficial when an ECA defect acceptance criteria is used or when welding high strength pipe material, such as X-100 or X-120.

Fourth, the P-600 is a self-calibrating system using encoder feed back on the motors that control the essential parameters (wire feed and travel speed). The operating software is designed such that only the qualified essential parameters and their limits are entered into the production program. Changes, within these boundaries, can be made in the field. Access to parameters is controlled by a smart card. Several levels of smart cards are issued. For instance inspectors are issued a smart card that only allows reading of parameters in use and down loading of actual parameters used during welding.

Fifth, the P-600 system has software designed to provide QA/QC information. It can be programmed to record essential parameters and calculate heat input during production welding. The parameters of interest can be selected and the frequency of data acquisition specified. The data can be down loaded via the smart card, a direct cable link to a computer or PDA or via blue tooth technology to a PDA.

Cost Reduction and Welding Procedures

One of the challenges with the P-600 was to develop welding procedures that deposited the same pass thickness as our standard single head system. If this could be achieved then the number of fill stations required for a typical wall thickness could be reduced by 50% for even number of fill passes and 30 % for odd number of fill passes.

Procedures have been developed over the normal range of wall thickness from 10 to 25mm that achieve this goal by the combination of optimum wire diameter, shield gas and precise development of the pulse parameters for the PGMAW process.

The latest advancement is digital to digital communication between the P-600 welding system and the PGMAW power supply. This high speed communication allows changing or altering the PGMAW program in co-ordination with position based parameters. And feedback control of arc parameters at



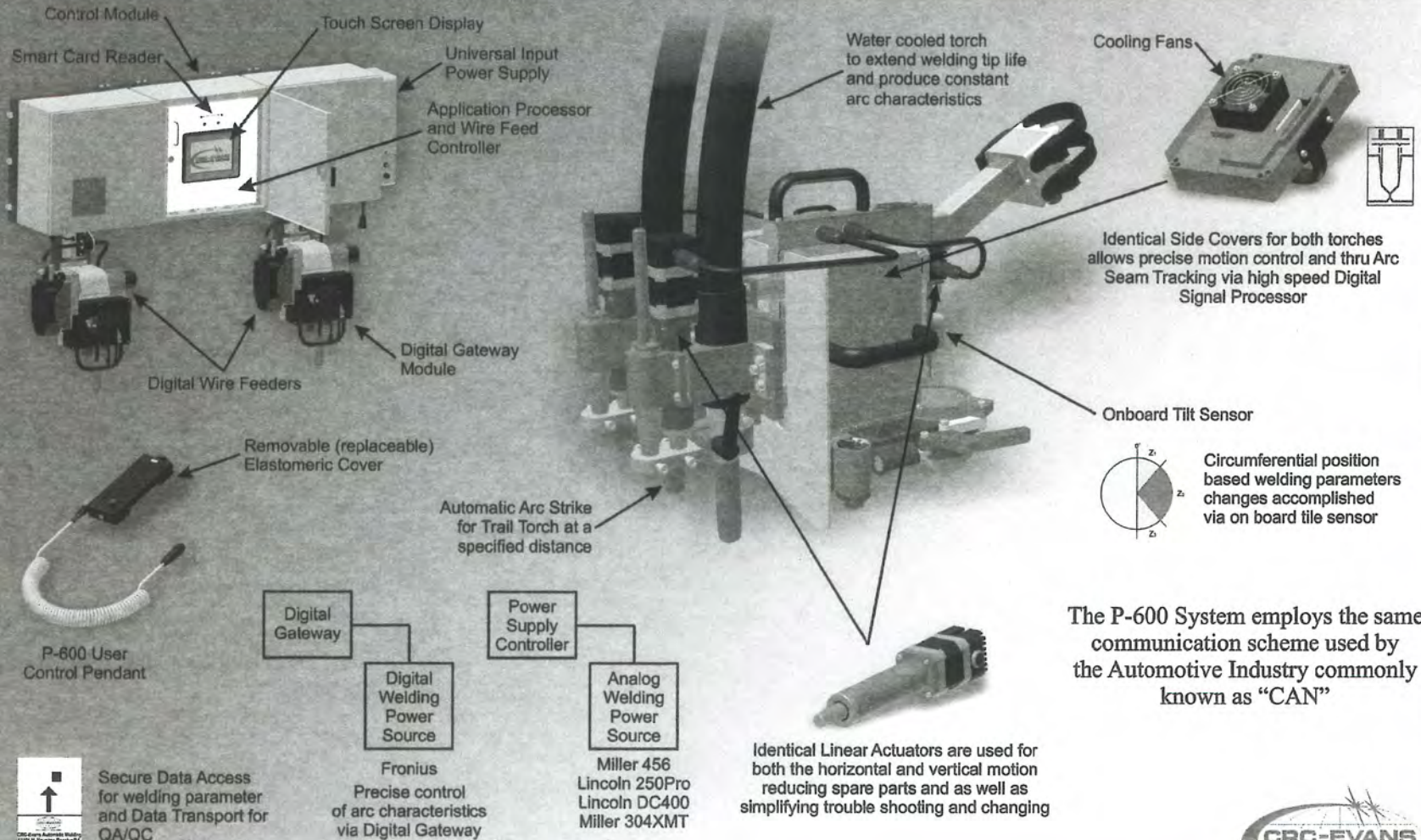
increased speeds ensures stable arc conditions. However, the most important benefit is close proximity of the welding torches. Typical torch spacing was 125mm with normal communication schemes. We have achieved a torch spacing of 60mm with digital control. This is a significant improvement in net productivity, as a shorter distance has to be welded in a typical pass cycle.

The cost reduction achieved using the P-600 system on the In Salah and BTC projects is difficult for CRC-Evans to define as we do not have access to the contractors financial information. However, the reduction in welding stations can be identified. For the In Salah project we have a direct comparison between the 48" GME project that used our single headed system and the 48" In Salah with our P-600 system. The welding crew on GME had 11 external welding stations but only seven were required on In Salah using the P-600 system. This is a total savings of twenty people (eight welders, eight helpers, four tractor drivers). Both projects were camp jobs. Significant saving were achieved for travel, living and wages for these people. In addition, four less welding tractors (shipping return, purchase or rental costs) and the operating expenses for this equipment. It is safe to assume this was a significant sum.

For BTC there is no direct comparison. However, the contractors used seven stations with the P-600. We estimate that a minim of ten stations would have been required to maintain the same production rate using our single head welding systems. Once again a significant amount was saved using the P-600 system.



P-600 External Welder



The P-600 System employs the same communication scheme used by the Automotive Industry commonly known as "CAN"



Secure Data Access for welding parameter and Data Transport for QA/QC



P-600 External Welder Track Record

Year	Project Name	Contractor	Location	Material	Length Miles[km]	# of Welds	Diameter	WT 1	WT 2	WT 3	Repair Rate %	Acceptance Criteria
2001	Colorado Interstate Gas Medicine Bow Loop	Murphy Brothers	USA	X-70	154 [248km]	10,000	36"	0.531	0.590	0.762	4.8	ECA
2002	Kern River Spreads 3, 7	Associated Pipeline	USA	X-70	129 [240km]	10,335	36"	0.429	0.618		5.5/2.0	ECA
	Kern River Spreads 5, 9	Gregory & Cook	USA	X-70	175 [282km]	11,500	36"	0.429	0.618		5.5	ECA
	In Salah Gas Phase I	Bechtel Ltd	Algeria	X-70	45 [72km]	2,978	24"	0.303			4.9	ECA
	In Salah Gas Phase I	Bechtel Ltd	Algeria	X-70	31.8 [52km]	2,462	38"	0.480			1.7	ECA
	In Salah Gas Phase I	Bechtel Ltd	Algeria	X-70	287 [462km]	18,687	48"	0.500	0.547	0.830	4.1	ECA
	Eastchester Extension Project	Horizon Offshore	USA	X-68, X-70	30 [48km]	4,579	24"	0.532	0.618		4.7	ECA
	Kern River Spread 10	ARB, Inc.	USA	X-70	82 [132km]	4,447	42"	0.429	0.720		8.5	ECA
2003	Hubline Project PB Contract Services	Stolt Offshore	USA	X-62, X-65	4 [6km]	883	30"	0.562	1.125		9.0	ECA
	Machenzie Gas Project WPD/WPD	EWI Microalloying	USA				30"	0.614				
	BTC Spread 1 Lot B1	Streicher/Alarko	Turkey	X-65	162 [261km]	18,000	42"	0.406	0.500	0.622	6.0	API1104
	BTC Spread 2 Lot B2	Streicher/Alarko	Turkey	X-65	144 [232km]	16,000	42"	0.406	0.500	0.622	5.1	API1104
	BTC Spread 3 Lot C2	Punj Lloyd/Limak	Turkey	X-65	77 [124km]	9,000	34"	0.343	0.465	0.560	4.9	API1104
	Nouras Offshore/EI Gamil to RPP Platform	Petrojet Offshore	Egypt	X-65	32 [52km]	4,266	26"	0.752			4.1	API1104
	Cameron Highway	Horizon Offshore	USA	X-70	85 [137km]	11,230	24"	0.516	0.846		2.5	ECA
2004	P600 Sale, Warranty Rep & Cust Training	American Dynamics	Vietnam	X-65		20,000	16"	0.500				
	Peerless Lake	Louisbourg Pipeline	Canada	X-100, X-120	2 [4km]	280	36"	0.520	0.630		3.8	ECA
	PDO Oman	Punj Lloyd/Limak JV	Oman	X-70	165.9 [267km]	20,800	48"	0.760	0.834		6.0	API1104
	CIG Spread 1 Cheyenne Plains	Associated Pipeline	USA	X-80	125 [201km]	8,000	36"	0.464	0.667		6.8	ECA
	CIG Spread 2 Cheyenne Plains	US Pipeline	USA	X-80	135 [217km]	8,775	36"	0.464	0.556	0.667	6.7	ECA
	CIG Spread 3 Cheyenne Plains	US Pipeline	USA	X-80	120 [193km]	7,754	36"	0.464	0.556	0.667	6.0	ECA
	P600 Sale	American Dynamics	Vietnam									
Totals					1986 [3196km]	189,956						

