

CASE STUDY



WELDED VS PYPLOK®

IN A LIVE HEAD-TO-HEAD APPLICATION

Purpose

The purpose of this report is to compare the results of using a traditional hot process, or welding, vs. a cold compression process, the Pyplok® mechanically attached fitting system, when joining pipe along the U-2400 lines in the Alusa site in Comperj.

Introduction

Mechanically attached systems are typically used to join small diameter pipe, usually between ¼" and 3", made of carbon steel, stainless steel, and nonferrous metals, and being used at high pressures for services such as gas, oil, compressed air, and steam limited to 260° C. In these systems, a seal is obtained using a portable, hand-held installation tool. Couplings are cold worked and permanently compressed onto the piping, thus forming a permanent leak-tight seal. This cold work can be used in applications where hot work, or welding, is too expensive, too dangerous, or otherwise logistically impossible, such as in classified areas.

Description of test procedure

We selected two lines from the project of the same material, diameter, number of joints, and geometry of the spool to compare both processes. Pipe preparation, coupling, and assembly of the two spools were made in the same conditions, at a work bench, by the same team, to avoid any influence in results due to the human factor. The two lines were accompanied by a dimensional inspector and were subjected to hydrostatic tests according to project specifications.

Lines selected for production test:

1"-AV-2400-444-Ce-IQ - Executed according to conventional hot process with flanges and welding socket connections.

1"-AV-2400-442-Ce-IQ - Executed with mechanical cold compression process with connections provided by Pyplok® fittings.

CONVENTIONAL WELDING PROCESS

1. Preparing the material
2. Cutting
3. Preparing the joints
4. Assembling spools
5. Tacking and setting the position
6. Performing dimensional inspection
7. Welding the fittings
8. Performing die penetration inspection
9. Completing hydrostatic testing

PYPLOK® COLD COMPRESSION PROCESS

1. Preparing the material
2. Cutting
3. Preparing the joints
4. Assembling spools
5. Compressing fittings with Pyplok® swaging tool
6. Performing dimensional Inspection
7. Completing hydrostatic testing

Test Data

DESIGN CONDITIONS

Application: Fluid - boiler water for steam generation in V-2400023

Design temperature: 223° C

Design pressure: 15.1 kg/cm2 (14.8 Bar)

Hydrostatic test result: 23.1 kg/cm2 (31.5 Bar)

Insulation: 38mm

OPERATING CONDITIONS

Temperature: 193° C

Operating pressure: 12.6 kg/cm2 (12.4 Bar)

TEST RESULTS

Comparative timetable

Fabrication process	Manual hot welding process	Pyplok® cold compression process
Phase	Time (min)	Time (min)
Preparation of pipe, including cutting plan and connection cleaning (resource: 2 pipe fitters)	75	60
Spool coupling with Pyplok® machine (resource: 2 pipe fitters; 1 operator)	N/a	38
Connection coupling using hot welding process (resource: 1 pipe fitter; 2 welders)	105	N/a
Welding connections (resource: 1 welder)	21	N/a
Visual inspection (resource: 1 end inspector)	15	N/a
Die penetration inspection (resource: 1 end inspector)	15	N/a
Dimensional inspection (resource: 1 dimensional inspector)	=	=
Hydrostatic testing	=	=
Total number of joints	12	12
Total time	231	98
Average time per joint	19.25	8.2

The times for dimensional inspection and hydrostatic testing are the same in both cases and are not considered in the execution time for the spool. The lines were subjected to hydrostatic testing to 23.1 kg/cm² (31.5 Bar) without leaks.

A bench test was performed on a test piece, using the same spool material, having a fitting compressed over two nipples. Pressure tested to 250 kg/cm² with no leaks.

A pneumatic test was performed on the spool assembled using Pyplok® system and no leaks were detected in 1"-AV-2400-442-Ce-IQ.

MAN-HOUR COMPARATIVE TABLE

Fabrication process by phase	Resource Type	Number of Personnel	Hourly Wage USD*	Adm. Factor	Cost USD*/h	Time	Welded system man-hours	Pyplok® system man-hours	Welded system cost USD*	Pyplok® system cost USD*
Preparation of pipe, including cutting plan and connection cleaning	Pipe fitter	2	9,17	2	18,34	60/75	150	120	2751,00	2200,80
Spool coupling with Pyplok® machine	Pipe fitter	2	9,17	2	18,34	38	0	76	0,00	1393,84
Coupling of connections with use of hot welding process	Operator	1	9,08	2	18,16	38	0	38	0,00	690,08
	Pipe fitter	2	9,17	2	18,34	105	210	0	3851,40	0,00
	Welder RX	1	11,14	2	22,28	105	105	0	2339,40	0,00
	Inspector	1	13,46	2	26,92		0	0	0,00	0,00
Welding connections	Welder RX	1	11,14	2	22,28	21	21	0	467,88	0,00
Visual inspection	Inspector	1	13,46	2	26,92	15	15	0	403,80	0,00
Die penetration inspection	Inspector	1	13,46	2	26,92	15	15	0	403,80	0,00
							516	234	2,024.83	849.13

*All costs converted to USD from Brazilian Real (1 USD = 0.20 R\$)

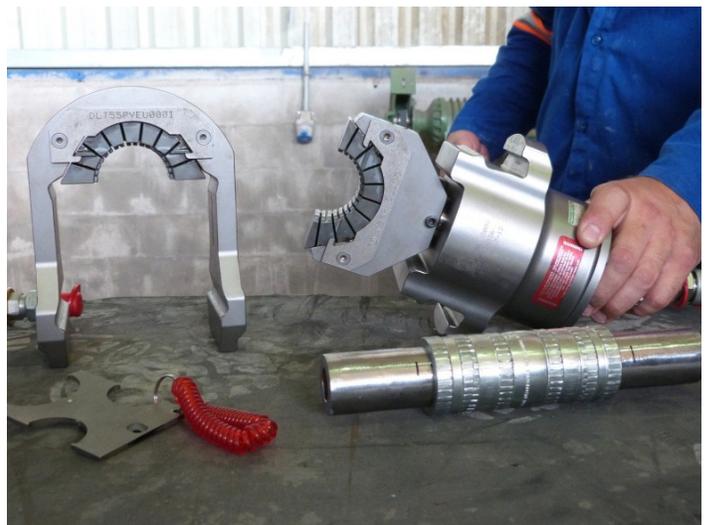
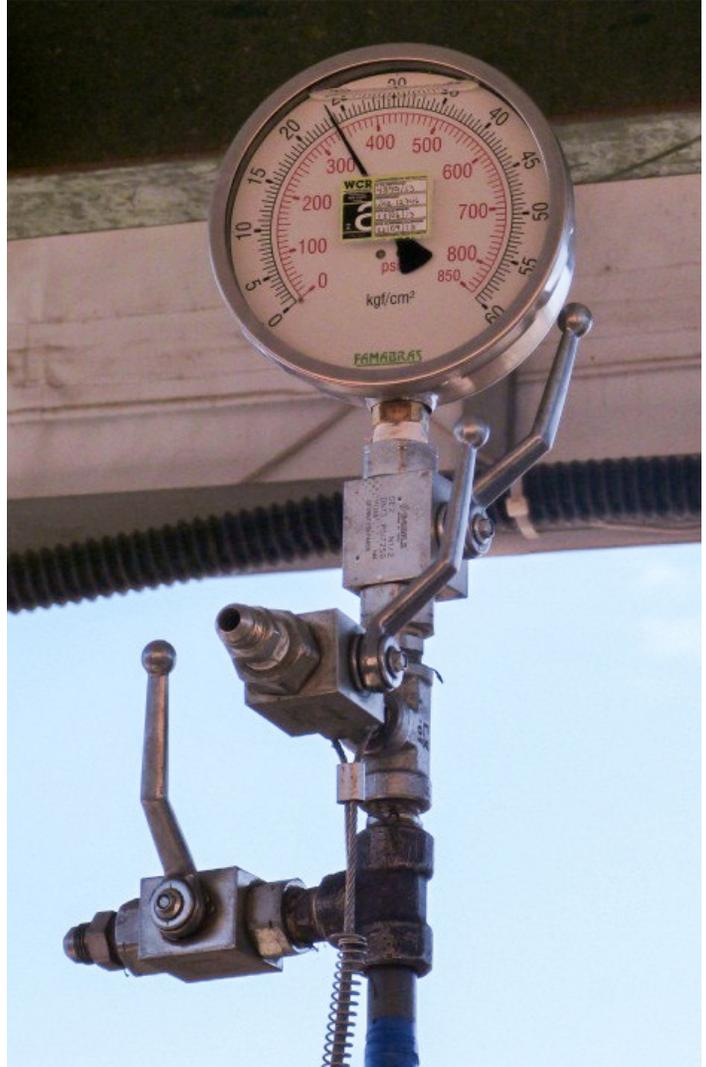
Conclusion

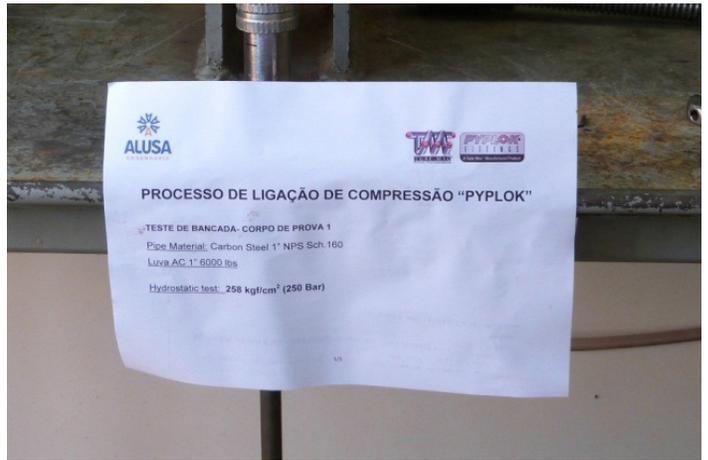
Pyplok® System Advantages:	Pyplok® System Disadvantages
<ul style="list-style-type: none"> • Faster execution by a factor of approximately 2 to 1 • Lower cost per joint • Greater portability of the equipment • Lower operating temperatures means lower risk • Fewer inspections - visual weld and die penetration inspections are unnecessary • Easier to install, especially for narrow lines across the field 	<ul style="list-style-type: none"> • Limited to piping system temperatures of 260° C • Size restriction on system nipples • Once compressed, a fitting can't be reused • Fitting technology is exclusive to Pyplok® • Materials are imported and not always readily available

Photo Report



Photo Report





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