

AG 51 møte.13. mars GPA AB, Hjärnarp

PE 100+ Association
Advisory Committee

Buttfusion Harmonisation

Proposed Butt-fusion Harmonisation Project for
the Welding of Large Diameter Polyethylene Pipe

Chairman appointed by PE 100+ Association

Buttfusion Harmonisation

Målsättning

- Målet är att få till en eller två ISO standardiserade svetsprocedurer
- Styrkta med hjälp av accepterade ISO testmetoder

Buttfusion Harmonisation

- 2004 - Inledande diskussion mellan PE 100+ och Marcogas
- Fas 1 - Utvärdering av testmetoder
- Fas 2 - Revision av ISO standarder/procedurer

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- Följande länder/organisationer har/kommer att kontaktats:-
Marcogas, UK Water/PDL, Germany DVS och DVGW, Becetel, GasTec och NEN, INSTA Scandinavia , PPI McElroy, Japan – Prime Polymers & Mitsui, Australia, Italy, tillverkare
- ISO 13953, WIS, DVS, metoder som används mest

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- Svets prover

- Siktat på rör med vägg tjocklek 30 mm, 50 mm, 70 mm pipe
- PE 100+ svart, samma material för alla rörstorlekar
- Bearbetning till tunnare provstavar (från det tjockaste röret) kan bli aktuellt
- Svetsningen kontrollerad och dokumenterad på plats
- Tillräckligt med prover så att de som är intresserade även kan utföra egen testning
- Erbjudande om gratis rör / svetsning

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- Test Programm (~ 1 år)

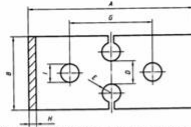
- WIS dragprovning med energimätning
- DVS böj test
- DVS EN 12814 kryp test
- Dessutom kommer Gas de France att köra några ytterligare tester

Buttfusion Harmonisation

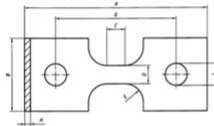
- ISO Standardisering

- Test metoder – SC5/WG12 Polyolefin Assemblies (P.Vanspeybroeck)
- Revidera ISO 13953 eller ta fram ny standard
- Kontrollera procedurer, revidera / gör tillägg i ISO 21307
- Kan tidigast starta när resultat från testprogrammet är tillgängliga, slutet av 2006
- Timing ca 2 år

ISO 13953



Påvestav type A, for veggtykkelse $e < 25$ mm



Påvestav type B, for veggtykkelse $e \geq 25$ mm

Tabell 1, dimensjoner på påvestaver type A og type B

Symbol	Description	Dimensions in millimetres		
		Dimensions of type A test piece $e < 100$	Dimensions of type A test piece $e \geq 100$	Dimensions of type B test piece
A	Overall length (mm)	150	150	250
B	Width at ends	60 $\pm$ 2	60 $\pm$ 2	100 $\pm$ 3
C	Length of narrow parallel-sided portion	Not applicable	Not applicable	25 $\pm$ 1
D	Width of narrow portion	25 $\pm$ 1	25 $\pm$ 1	25 $\pm$ 1
E	Radius	5 $\pm$ 0,5	10 $\pm$ 0,5	25 $\pm$ 1
G	Initial distance between grips	90 $\pm$ 5	90 $\pm$ 5	165 $\pm$ 5
H	Thickness	Full wall thickness	Full wall thickness	Full wall thickness
T	Diameter of the traction holes	20 $\pm$ 5	20 $\pm$ 5	30 $\pm$ 5

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- ISO Standardisering

- ISO/TC 138/SC4 AHG/Buttfusion harmonisation
- Ordförande E.Striplin (tidigare T.Hill)
- För tillfället 3 metoder
 - European/US single cycle
 - UK Dual pressure
- På röstning som “New Work Item WD 21307”

ISO/DIS 21307



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- Gå igenom existerande information beträffande test metoder som används idag
- Utvärdera tester baserade på lång tid (SCG och procedurerutvärdering) och kort tid (repetierbarhet kvalitetskontroll)
- Få stöd för föreslaget testprogram
- Harmonisera tester inom ISO och justera/revidera "ISO butt-fusion procedure harmonisation" dokument

Norges kommentarer til ISO/DIS 12176-1

" In "1Scope" of ISO/FDIS 12176 -1, second paragraph, it is made reference to ISO 4427-2 and ISO 4427-3. Because the latest draft of the revised ISO

4427-2 the dimension range is increased to include pipes up to and included 2000 mm, some modifications must be made in ISO/FDIS 12176-1.

Page 4 Table 1 - Maximum time for removing the heating plate

The column for "Nominal wall thickness, en" , must be increased from 70 to 120 mm. The column "Maximum time" must be increased to cover the higher wall thickness.

Page 5 Table - Maximum deflection (to be tested with SDR 17,6 or SDR 17 pipes)

In the column "Nominal outside diameter" , 2000 mm must be added. A new value for Dim. 2000 mm must be added in column "Maximum deflection".

Pipelife - Erfaringer

REGISTER FOR PRØVING AV SVEISTE PE80 OG PE100-RØR I HENHOLD TIL DS/INF 7C

Dato	Dimensjon	Material type	2 % treppol	SP Geseborg	Kommentar
			DS INF 7C 80C Modellverdi i timer	ISO 13003 Type brudd	
25.05.01	1400 sdr26	PE80	437	Ductile	
13.03.01	1200 sdr33	PE80	517	Ductile	
07.05.01	1000 sdr26	PE80	297	Ductile	
02.06.03	1600 sdr26	PE100	>205	Ductile	
02.06.03	1600 sdr26	PE100	>270		Prøve avbrutt ubrudd
10.06.03	1600 sdr26	PE100	>200		Prøve avbrutt ubrudd
03.04.03	1600 sdr26	PE100	>371	Ductile	
21.05.03	1600 sdr26	PE80	>1000	Ductile	
29.03.04	1400 SDR21	PE100	>205	Ductile	
03.03.04	1400 SDR21	PE100	>467		Prøve avbrutt ubrudd
05.05.04	1400 SDR21	PE100	>363		Prøve avbrutt ubrudd
02.02.04	1400 SDR21	PE100	>165	Ductile	
20.12.04	1200 SDR22	PE80	>170		Prøve avbrutt ubrudd
01.12.04	1200 SDR22	PE80	>215		Prøve avbrutt ubrudd
08.11.04	1200 SDR22	PE80	>165		Prøve avbrutt ubrudd
06.09.04	1400 sdr26	PE80	>180	Ductile	Bege ut hos SP
10.02.05	1400 sdr33	PE80	>165	Ductile	
09.05.05	2000 sdr30	PE80	>175		Prøve avbrutt ubrudd
09.05.05	2000 sdr26	PE80	>700	Ductile	
01.03.05	1400 sdr26	PE80	>300	Ductile	
07.07.05	1600 sdr26	PE80		Ductile	
27.09.05	900 sdr11	PE100	>429		Utøst hos SP
06.09.05	900 sdr11	PE100	>210		Prøve avbrutt ubrudd
26.05.05	900 sdr11	PE100	>200		Prøve avbrutt ubrudd
05.10.05	1800 sdr26	PE80	>200	Ductile	

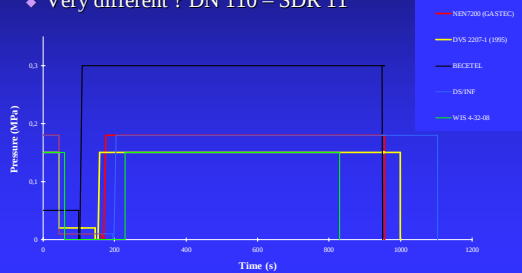
+ 710 SDR11 PE80 8-10 prøver
testet hos CINTEF

Hvilke parametere bruker du ?

Butt Fusion Jointing of PE Systems

■ Fusion procedure – A multitude of procedures

◆ Very different ? DN 110 – SDR 11



ISO/DIS 21307

ISO/DIS 21307

5 Butt Fusion Welding Procedures

5.1 Single Pressure – Low Procedures

Heater plate temperature 200° C ± 20°

Initial dead-up pressure – 0.15 MPa (+/- 0.02 MPa)

Heat soak time – See Table 1

Heat soak pressure – 0 to drag

Heater plate removal time – See Table 1

Interface fusion pressure – 0.15 MPa (+/- 0.02 MPa)

Time to Achieve Interface Fusion Pressure – See Table 1

Cooling time (in machine clamps) – See Table 1

Cooling time (out of machine) – See Note 4 in Table 1



Fig 1 – Typical Single Pressure – Low Butt Fusion Cycle (not to scale)

Tabell no. 1

8 Tables

Table 1-Single Pressure and Dual Pressure – Low Procedures (formula for calculating fusion parameters)

A.1.1.1 Wall thickness (e) (mm)	A.1.1.2 Initial bead size (mm)	A.1.1.3 Heat soak Time (seconds)	A.1.1.4 Heater Plate Removal Time (seconds)	Time to achieve interface fusion pressure (seconds)	Cooling time (minutes)
	Heat soak rate heater plate at the end of the bead up time (interface fusion pressure 0.15MPa) (mm)	Heat soak time = 10 x wall thickness (heating up with = 0.025MPa) Note (1) (minimum)	Note (2) (maximum)	(hydraulic) (0.15MPa) Note (4)	
$e \leq 4.5$	0.5	45	5	5	8
$4.5 < e \leq 7$	1.0	45 - 70	5	5 - 6	8 - 10
$7 < e \leq 12$	1.5	70 - 120	5	6 - 8	10 - 16
$12 < e \leq 19$	2.0	120 - 190	5 - 10	8 - 11	16 - 22
$19 < e \leq 26$	2.5	190 - 260	10 - 12	11 - 14	22 - 32 (3)
$26 < e \leq 37$	3.0	260 - 370	12 - 16	14 - 19	32 - 45 (3)
$37 < e \leq 50$	3.5	370 - 500	16 - 20	19 - 25	45 - 60 (3)
$50 < e \leq 70$	4.0	500 - 700	20 - 25	25 - 35	60 - 80 (3)

Note 1 - These times are a minimum. Increasing heat soak time leads to larger weld beads and longer cooling times that can be advantageous in low ambient temperature conditions.

Note 2 - These times are a maximum. Every effort should be made to reduce these times whenever possible to protect molten surfaces against rapid cooling.

Note 3 - If using dual pressure techniques for pipes with wall thickness above 20mm, the interface fusion pressure is reduced during the cooling stage to 0.025MPa after 10 seconds of bringing the pipe ends together.

Note 4 - This is the cooling time for the butt joint when still in the machine and under pressure. These are based on a cooling time of 40 minutes per mm of wall thickness on walls from 5 mm through 30 mm and 1.25 minutes on wall thickness above 30 mm. Cooling times for wall thickness between the ranges listed in column 1 can be interpolated from the given times. A further cooling time out of the machine and before rough handling is also recommended. Typically, this is equal to the cooling time under pressure. Cooling times may require lengthening or shortening depending upon ambient temperatures.

Tabell no. 2

Table 2 - SINGLE PRESSURE - HIGH Procedures (formula for calculating fusion parameters)

Wall thickness (e) (mm)	Heat soak pressure (MPa) Note 1	Minimum required final melt bead size (mm) Note 3	Maximum heater plate removal time (seconds)	Fusion and cooling interface pressure (MPa)	Cooling time in machine under pressure (minutes) Note 4
$5 < e \leq 9$	0 - drag	1.5	8	0.517	2.5 - 4
$9 < e \leq 14$	0 - drag	3.0	10	0.517	4 - 6
$14 < e \leq 30$	0 - drag	5.5	15	0.517	6 - 13
$30 < e \leq 70$	0 - drag (2)	8.5	20	0.517	21 - 49

Note 1 - No pressure is applied but a value equal to drag may be applied to maintain contact between pipe ends and heater plate.

Note 2 - Interface contact pressure may be applied for a very brief time, sufficient to ensure good thermal contact between pipe ends and heater plate as evidenced by an indication of bead bridged the circumference of both pipe ends.

Note 3 - Minimum bead size is generated through thermal expansion of the polymer only. Once required bead size is achieved, pipe ends are separated, the heater plate is repositioned and the pipe ends are brought together under the fusion interface pressure. These values are a minimum and can be increased, however, this would inevitably increase joint cooling times.

Note 4 - This is the cooling time for the butt joint when still in the machine and under pressure. These are based on a cooling time of 43 minutes per mm of wall thickness on walls from 5 mm through 30 mm and 70 minutes on wall thickness above 30 mm. A further cooling time out of the machine and before rough handling may be recommended. Typically, this is equal to the cooling time under pressure.

PE100+ Prosjektet

- The welding procedures and test methods to be used are still exactly as presented at the PE 100+ Advisory Meeting in Barcelona last year, ie :-
- Procedures – European Single Pressure, UK Dual Pressure, USA High Single Pressure – these are described in ISO DIS 21307.
- Test Methods – UK WIS tensile test, DVS EN 12814 Bend test and DVS EN 12814 Long term Creep test



