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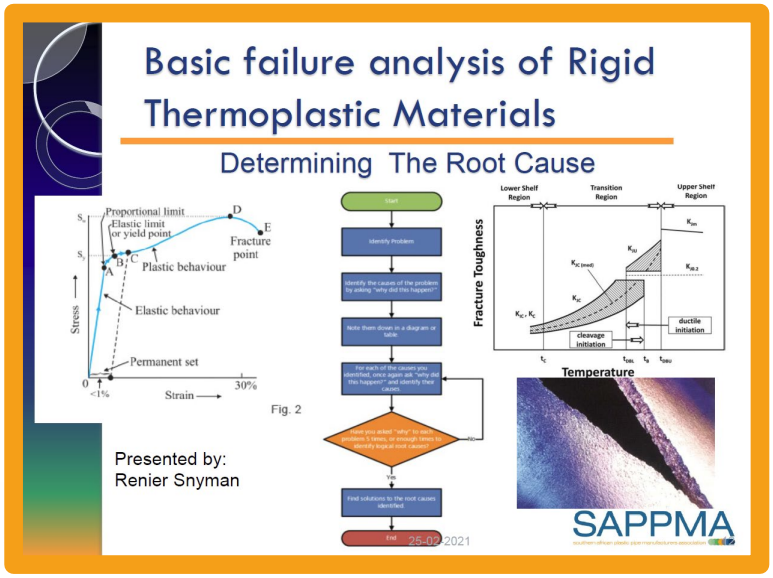
WEBINAR II

March 2021

24-03-2021

SAPPMA Webinar I on SAPPMA Web site



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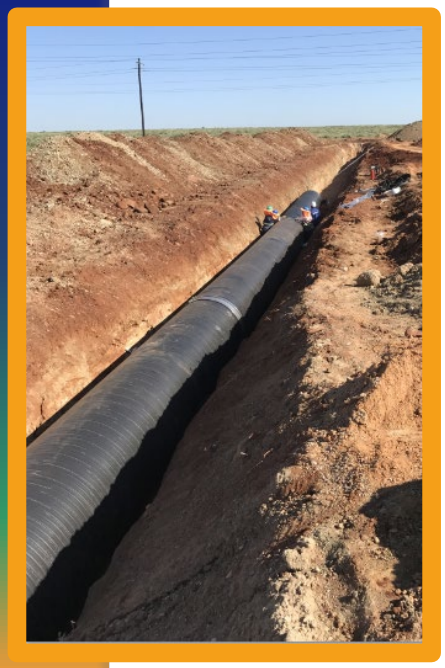
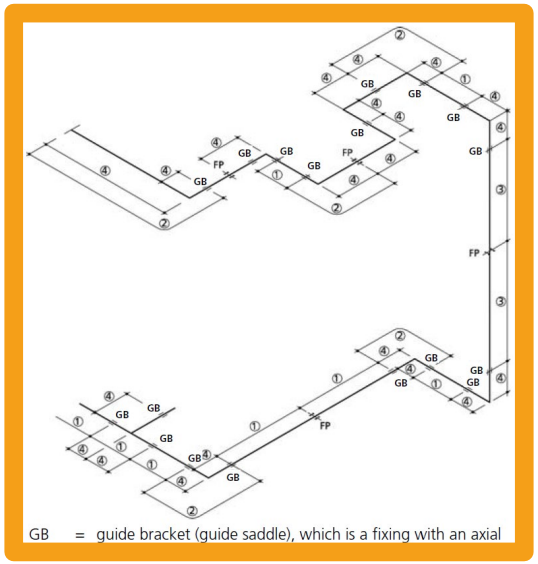
We will gladly have you and your organisation present a project completed with thermoplastic pipe





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Presenter

24 March 2021

Ian Venter

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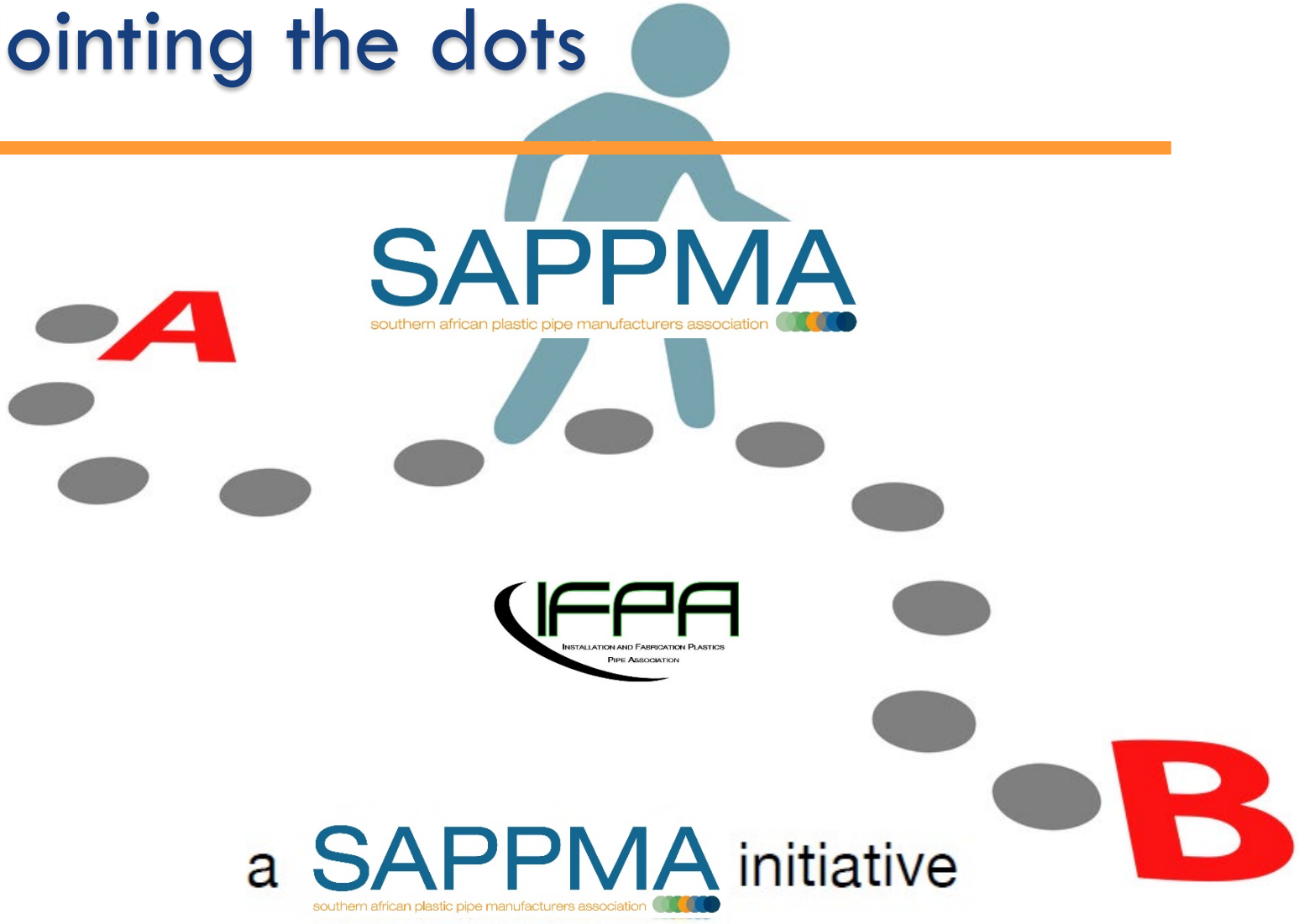
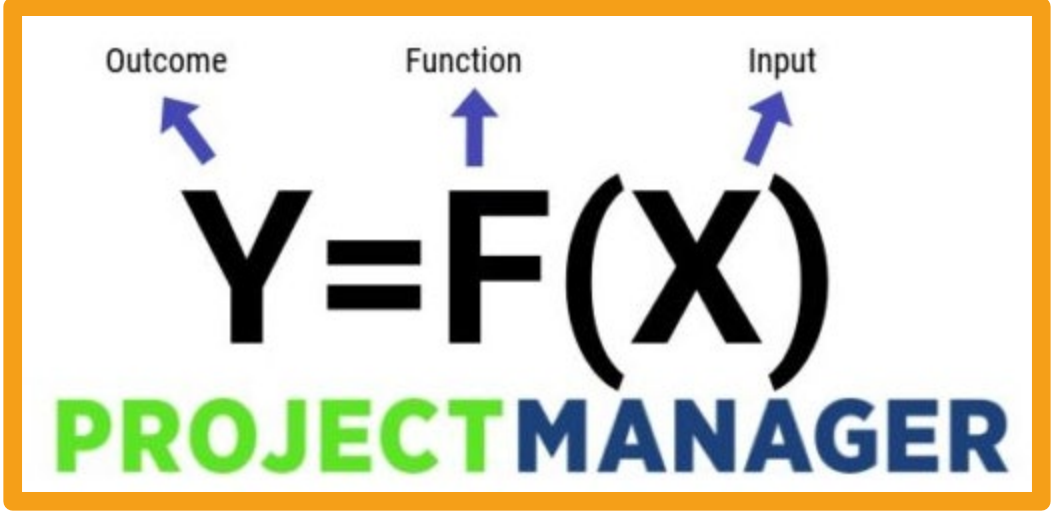
Jointing the dots



Jointing makes the System Work

Running Water needs Effective and functional Joints



SIGMA NOTATION

(represents the sum of a sequence)

Upper Limit (where to stop)

Argument (expression to be added)

Greek letter "Sigma" (summation symbol)

Lower Limit (where to start)

$$\sum_{k=1}^{n} x_k$$

Sum of the values of X from X_1 through X_n

$$\sum_{i=1}^{n} a_i = a_1 + a_2 + \ldots + a_n$$

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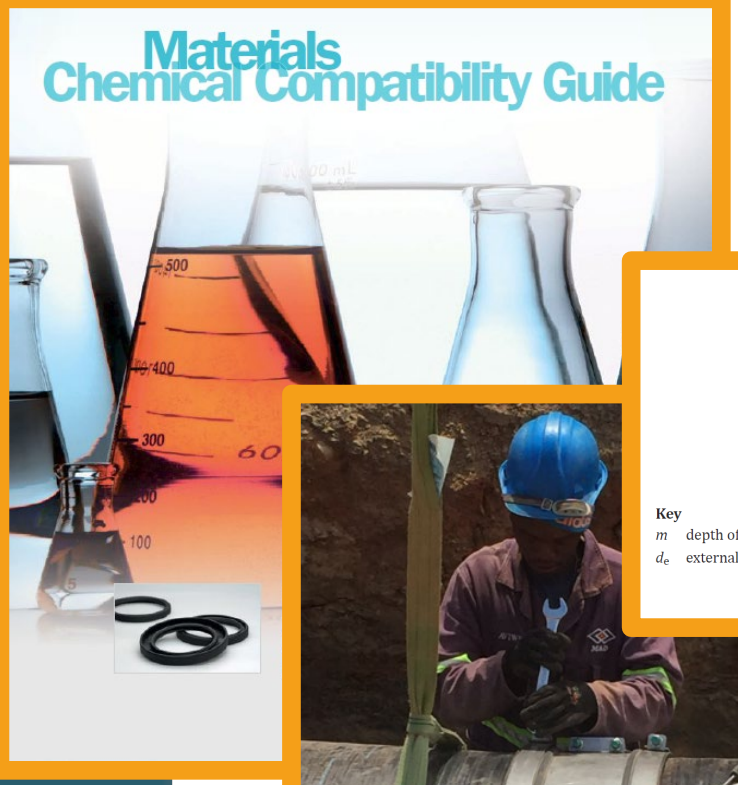
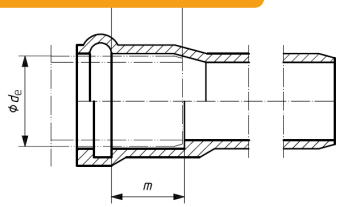
All joints rely on the degree of focus given to the input variables





Key
m depth of engagement
d_e external diameter of pipe

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Welding standards at a glance

- SANS1655
- SANS1671-1
- SANS1671-2
- SANS1671-3
- SANS1671-4
- SANS1671-6
- SANS6269
- SANS10268-1
- SANS10268-2
- SANS10268-3
- SANS10268-4
- SANS10268-5
- SANS10268-6
- SANS10268-10
- SANS10269
- SANS10270

wow[1]

/waʊ/

INFORMAL

exclamation

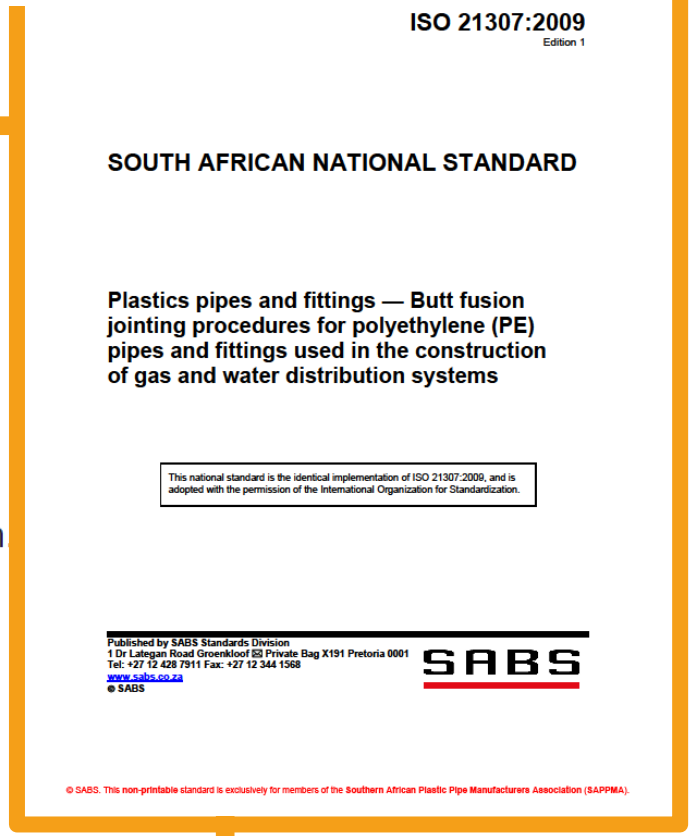
expressing astonishment or admiration.
"'Wow!' he cried enthusiastically"

noun

a sensational success.
"your play's a wow"

verb

impress and excite (someone) greatly.
"they wowed audiences on their recent British tour"



ISO 21307:2009
Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Plastics pipes and fittings — Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

This national standard is the identical implementation of ISO 21307:2009, and is adopted with the permission of the International Organization for Standardization.

Published by SABS Standards Division
1 Dr Lategan Road Groenkloof ✉ Private Bag X191 Pretoria 0001
Tel: +27 12 428 7911 Fax: +27 12 344 1568
www.sabs.co.za
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Welding standards continue

WELDING OF THERMOPLASTICS STANDARDS **2 February 2005**

SANS No (New Numbers)	TITLE
10268-1	Processes- **Pt.1: Heated tool**
10268-2	Processes- **Pt.2: Electrofusion wldg**
10268-3	Processes- **Pt.3: Hot-gas welding**
10268-4	Processes- **Pt.4: Hot-gas extrusion**
10268-5	Processes- **Pt.5: Solvent welding**
10268-6	Processes- **Pt.6: Ultrasonic welding**
10268-7	Processes- **Pt.7: Infra-red welding**
10268-8	Processes- **Pt.8: Bead & crevice free**
10268-9	Processes- **Pt.9: Spin & friction wlg**
10268-10	Processes- **Pt.10: Weld defects**
1671-1	Machines- **Pt.1: Heated tool wlding**
1671-2	Machines- **Pt.2: Electrofusion wldg**
1671-3	Machines- **Pt.3: Hot-gas welding**
1671-4	Machines- **Pt.4: Hot-gas extrusion**
1671-5	Machines- **Pt.5:Solvent welding**
1671-6	Machines- **Pt.6: Ultrasonic welding**
1671-7	Machines- **Pt.7: Infra-red welding**
1671-8	Machines- **Pt.8: Bead & crevice free**
1671-9	Machines- **Pt.9: Spin or friction**
6269 (Was SABS SM1269)	**Test methods for welded joints**
1655	**Welding rods, fillers and solvents**
10269	**Testing and approval of welders**
10270	**Approval of welding procedures**

Note – The major change to the numbering system is that the numbers which previously started with a zero (0), now have a 1 in front of them.

SANS 10268-1 covers
Heated-tool butt welding
& Heated-tool socket welding

SANS 1671-1 covers
Heated-tool butt welding
& Heated-tool socket welding

- SANS1655
- SANS1671-1
- SANS1671-2
- SANS1671-3
- SANS1671-4
- SANS1671-6
- SANS6269
- SANS10268-1
- SANS10268-2
- SANS10268-3
- SANS10268-4
- SANS10268-5
- SANS10268-6
- SANS10268-10
- SANS10269
- SANS10270

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SANS 10270

Contents

Annex C
(informative)

Example of welding procedure specification qualification report (WPS-QR)

Checking, examination and test results: Heat-welded or solvent-welded joints

Contractor's welding procedure specification (WPS) No. .....
Job reference No. .....
Inspector: .....
Inspector's reference No. .....

Visual examination:
Result: Complies/Does not comply .....

Bending test: (If applicable)
Result: Complies/Does not comply .....

Tensile test:
Result: Complies/Does not comply .....

Other tests (specify): .....
Result: Complies/Does not comply .....

Examination and test sheets to be attached.

Remarks: .....
.....

Tests carried out in accordance with .....
Name of testing facility .....
Laboratory report reference No. .....

The test results **Comply:** ..... **Do not comply:** .....

Inspector's name	Date	Inspector's signature

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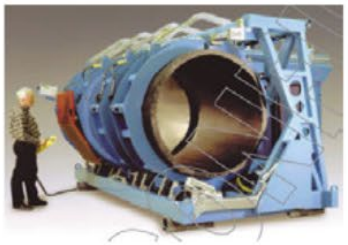
Making the Connection

Plastics | SA WELDING OF THERMOPLASTICS



WELDING APPROVALS

Welder basic skills training (SANS 10269)

Approval testing is carried out prior to production commencing and is an essential quality assurance measure, it confirms that the processes used are suitable and that the components in the system can be welded to standard.

Renée McLean
Training Administrator
Phone 011 653 4797 | **Fax** 086 612 4368

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Key Steps to obtaining a Welding Certificate

8 Summary of approval procedure

8.1 The contractor compiles a P-WPS and submits it to the customer.

8.2 A qualification weld is carried out under conditions as previously described in this standard, and under the supervision of the inspector.

8.3 The inspector completes a certificate of compliance with the P-WPS (see annex B) and submits joints for tests.

8.4 Upon satisfactory completion of the tests, the inspector completes the WPS-QR (see annex B).

8.5 The P-WPS can then be reissued as the final WPS.

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Confirming the Process and Procedures

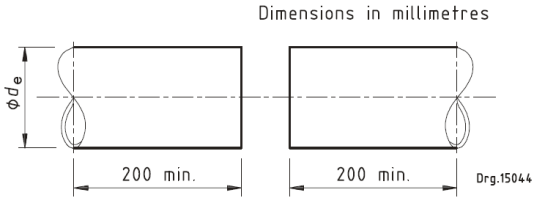

Figure 2 — Qualification joint for butt welding of pipes (heated-tool welding)

9 Qualification file

The contractor retains the qualification file which consists of the following:

– the WPS;
– the certificate of compliance;
– the WPS-QR;
– the report on each of the destructive tests; and
– the test specimens tested.

At the end of the project, the qualification file shall be handed to the customer.

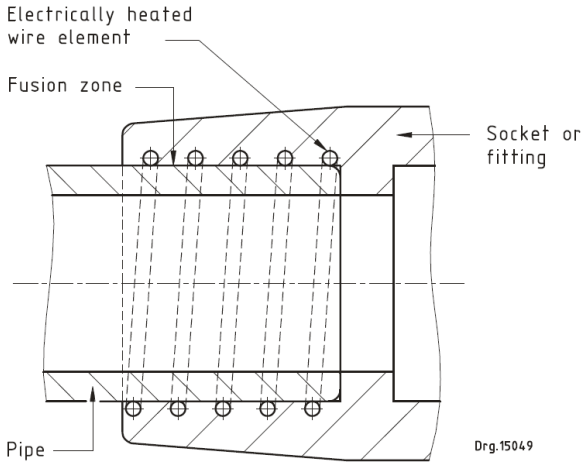

Figure 6 — Qualification joint for electrofusion welding

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P-WPS ends up as WPS

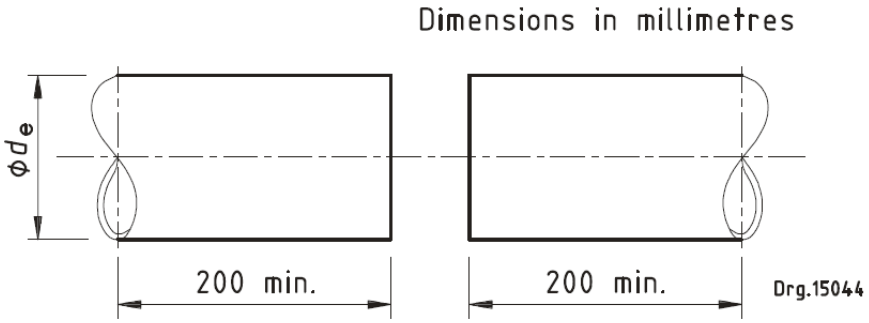
3.1.15
preliminary welding procedure specification
P-WPS
a draft copy of a proposed welding procedure specification which is assumed by the contractor to be adequate, before acceptance by the customer. This document might have to be modified if initial test results prove unsatisfactory

NOTE Typical P-WPS formats are shown in annex B.

5.2.3 Butt welding of pipes

The qualification joint for butt joints in pipes shall be in accordance with the example given in figure 2.

The preparation of the joint shall be in accordance with the P-WPS.



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It is all part of the P-WPS

4.4 Communication of preliminary welding procedure specification (P-WPS)

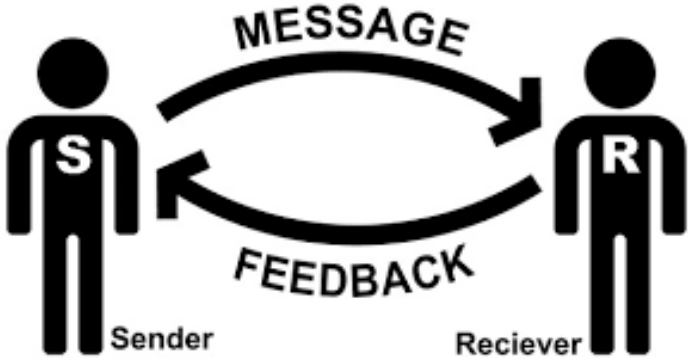
Before welding takes place, copies of the P-WPS shall be handed out and explained by the proposed contractor to the welding personnel and to the inspector.

4.5 Identification of qualification joints

Qualification joints shall be identified by reference numbers given in the proposed contractor's P-WPS.

4.6 Supervision and record keeping

Welding of the qualification joints and inspection of the test specimen shall take place under the supervision of an inspector, who shall check and record the identification and traceability of the welding materials used and the identity of the welding personnel. The inspector shall ensure that the qualification joints are in accordance with the provisions of the P-WPS.



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Inspector

4 Witnessing the testing of welders

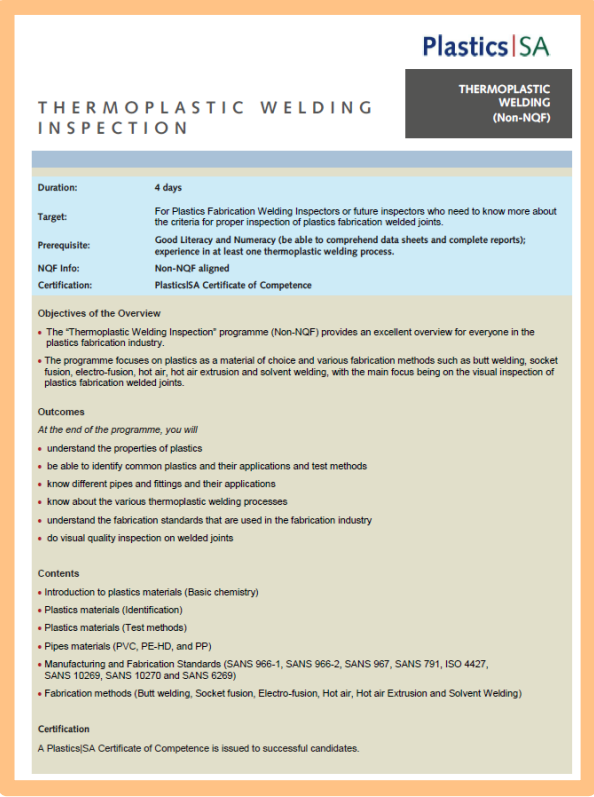
SANS 10269

An inspector approved by a recognised national training authority (NTA) shall witness the testing of the welder. The inspector shall have at his disposal all the necessary equipment to carry out the mechanical tests on the welded specimens. **Amdt 4**

3.1.13
inspector

SANS 10270

independent person who has been certified or recognized (or both) and who inspects welding procedures as per SANS 10268 part 1 to 5 and welds as per SANS 10268-10 and SANS 6269 for compliance with the provisions of this standard **Amdt 2**



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THERMOPLASTIC WELDING INSPECTION

THERMOPLASTIC WELDING (Non-NQF)

Duration:	4 days
Target:	For Plastics Fabrication Welding Inspectors or future inspectors who need to know more about the criteria for proper inspection of plastics fabrication welded joints.
Prerequisite:	Good Literacy and Numeracy (be able to comprehend data sheets and complete reports); experience in at least one thermoplastic welding process.
NQF Info:	Non-NQF aligned
Certification:	PlasticsISA Certificate of Competence

Objectives of the Overview

- The "Thermoplastic Welding Inspection" programme (Non-NQF) provides an excellent overview for everyone in the plastics fabrication industry.
- The programme focuses on plastics as a material of choice and various fabrication methods such as butt welding, socket fusion, electro-fusion, hot air, hot air extrusion and solvent welding, with the main focus being on the visual inspection of plastics fabrication welded joints.

Outcomes

At the end of the programme, you will

- understand the properties of plastics
- be able to identify common plastics and their applications and test methods
- know different pipes and fittings and their applications
- know about the various thermoplastic welding processes
- understand the fabrication standards that are used in the fabrication industry
- do visual quality inspection on welded joints

Contents

- Introduction to plastics materials (Basic chemistry)
- Plastics materials (Identification)
- Plastics materials (Test methods)
- Pipes materials (PVC, PE-HD, and PP)
- Manufacturing and Fabrication Standards (SANS 966-1, SANS 966-2, SANS 967, SANS 791, ISO 4427, SANS 10269, SANS 10270 and SANS 6269)
- Fabrication methods (Butt welding, Socket fusion, Electro-fusion, Hot air, Hot air Extrusion and Solvent Welding)

Certification

A Plastics|SA Certificate of Competence is issued to successful candidates.

Plastics|SA

Certificate

Accreditation Number 17-QA/ACC/0109/07
In compliance with the MERSETA Education and Training Quality Assurance

ID Number

was found competent in the following programme

Thermoplastic Welding Inspection

encompassing the following processes:

Butt Welding (HS), Hot Air Welding (WF)
Extrusion Welding (WE), Electro-Fusion Welding (HM)
Socket Fusion Welding (HD), Solvent Welding (SW)

Training Executive - Kirtida Bhana
Learner No: PFSA 105921

Regional Training Manager - Isaya Ntuli
October 2020

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SANS 1671-1

Welding of thermoplastics — Machines and equipment

Part 1: Heated-tool welding

1 Scope

1.1 This part of SANS 1671 specifies requirements for machines and equipment used for heated-tool butt welding and socket welding of thermoplastics, in particular for the welding of polyethylene (PE), polypropylene (PP), polybutylene (PB) and polyvinylidene fluoride (PVDF). It is intended as a general guide to good design practice for machine manufacturers.

Validity range

- **6.1 General**

All conditions of validity mentioned below shall be met, **each one independent of any of the others.**

If the validity range is exceeded, a new qualification test for the WPS shall be carried out.

The WPS welds which are normally intended to be made on site may be done in a workshop, unless the customer explicitly requests otherwise.

Validity range

6.1.1 Essential variables for heat welding

- The following essential variables are applicable to all heat welding:
- a) contractor;
- b) base and filler material;
- c) thickness of the material;
- d) preparation angle of bevel;
- e) welding process; and
- f) joint types.

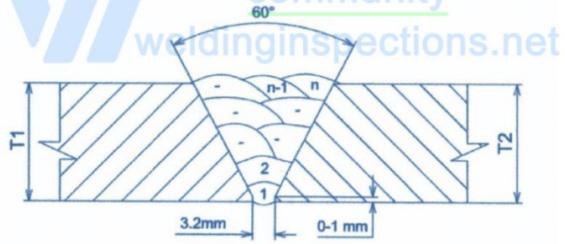
6.1.2 Essential variables determined by the type of heat-welding process

6.1.2.1 Heated-tool welding

- The following essential variables are applicable to heated-tool welding:
- a) temperature;
- b) pressure;
- c) cleaning agent; and
- d) time.

ISO 15614-1: 2017

Essential Variables



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SANS 10270 Annex A

Annex A
(normative)

Joint types

Table A.1 — Heat-welded joint groups (with filler material)

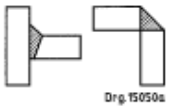
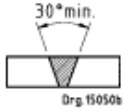
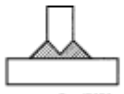
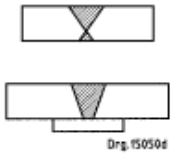
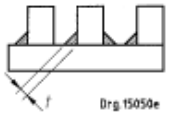
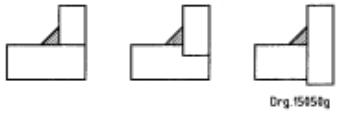
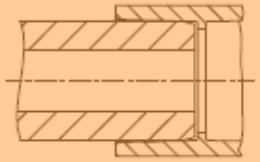
1	2	3
Definition of weld	**Fillet (Group A)**	**Butt (Group B)**
1 Single V joint without sealing run and without backing strip	 Drg.15050a 1A	 30° min. Drg.15050b 1B
2 Full fusion double V joints Full fusion single V joint with permanent or temporary backing strip	 Drg.15050c 2A	 Drg.15050d 2B
3 Double V joint or fillet joint with or without full penetration	 f Drg.15050e 3A	 Drg.15050f 3B
1 Branch, flange type weld, fillet welded without bevel	**Branch (Group P)**	
	 Drg.15050g 1P	
2 Branch, bevelled and penetration-welded (sit-on) Branch across bevelled piece (sit-in)	2P Without sealing run  Drg.15050h	2P(S) With sealing run  Drg.15050

Table A.2 — Heat-welded joint groups (without filler material)

1	2	3
Definition of weld	**Fillet (Group A)**	**Butt (Group B)**
1 Butt		 Drg.15051a
Mitre Dressed mitre	 Drg.15051	
2 Heated-tool socket-welded pipes	**Socket (Group E)**  Drg.15051b	

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Validity range

6.6 Welding process

A qualification is obtained only for the welding process used to create the qualification joint.

A qualification that is obtained using a number of welding processes remains valid only if the order of application of the processes is the same as during the qualification test.

6.7 Types of joint

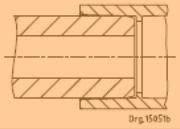
Table 2 gives the validity ranges for the types of qualification joint relative to table A.1 of annex A.

Table 2 — Validity range according to qualification joint (heat welding)

1	2	3	4	5	6	7	8	9
Group 1B	Group 2B	Group 3B	Group 1A	Group 2A	Group 3A	Group 1P	Group 2P	Group 2P(s)
X	·	·	·	·	·	·	·	·
	X	·		·	·	·		·
					X			
					·	X		
			·	·	·	·	X	·
				·	·	·		X

NOTE A qualification obtained for X also implies qualification for all the ·'s in the same horizontal line, provided that all the other variables are also the same.

Table A.2 — Heat-welded joint groups (without filler material)

1	2	3
Definition of weld	Fillet (Group A)	Butt (Group B)
1 Butt / Mitre / Dressed mitre		
2 Heated-tool socket-welded pipes	Socket (Group E) 	

There is no validity range for the joint types given in table A.2 of annex A. Each joint has to be qualified in its own right.

Validity range

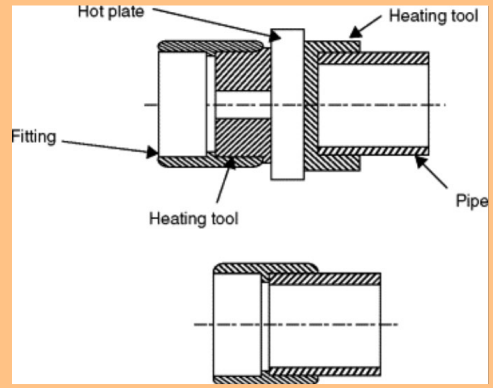
6.8 Validity in respect of the welding process

6.8.1 Heat-welding processes

6.8.1.1 Heated-tool welding

The qualification obtained is limited to the type of machine, for example, pipe, sheet or profile welding machines. The qualification is also limited to the hot-plate coating or material (for example,

anti-adhesion coating, aluminium, polished stainless steel, PTFE-glass fibre sheet) used during the qualification test



Testing and approval

For testing of the finished welds, see SANS 6269.

For approval of welders, see SANS 10269.

For approval of welding procedures, see SANS 10270.

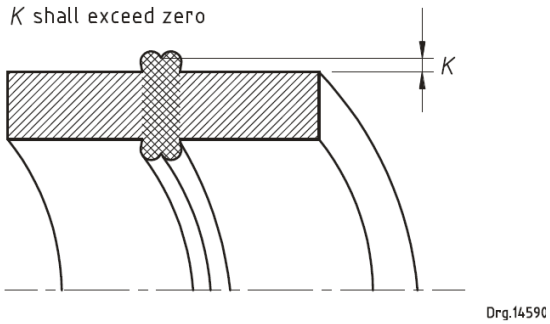
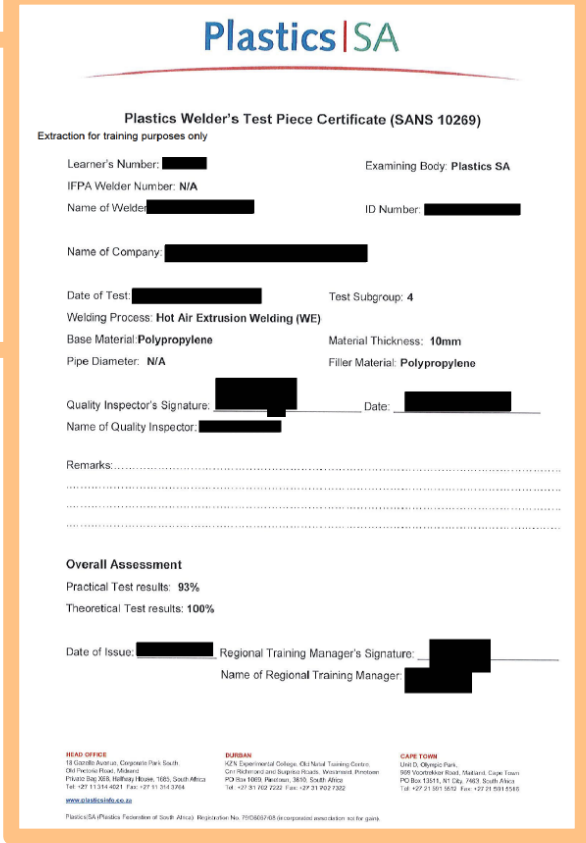


Figure 5 — Bead formation



Plastics|SA

Plastics Welder's Test Piece Certificate (SANS 10269)

Extraction for training purposes only

Learner's Number: [redacted] Examining Body: **Plastics SA**

IFPA Welder Number: **N/A**

Name of Welder: [redacted] ID Number: [redacted]

Name of Company: [redacted]

Date of Test: [redacted] Test Subgroup: **4**

Welding Process: **Hot Air Extrusion Welding (WE)**

Base Material: **Polypropylene** Material Thickness: **10mm**

Pipe Diameter: **N/A** Filler Material: **Polypropylene**

Quality Inspector's Signature: [redacted] Date: [redacted]

Name of Quality Inspector: [redacted]

Remarks:

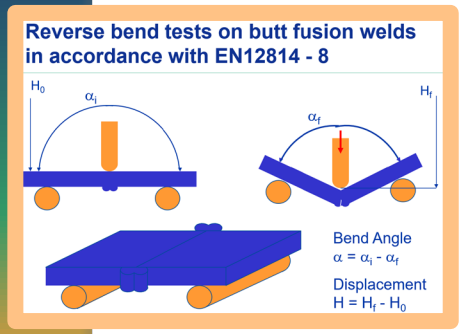
Overall Assessment

Practical Test results: **93%**

Theoretical Test results: **100%**

Date of Issue: [redacted] Regional Training Manager's Signature: [redacted]

Name of Regional Training Manager: [redacted]



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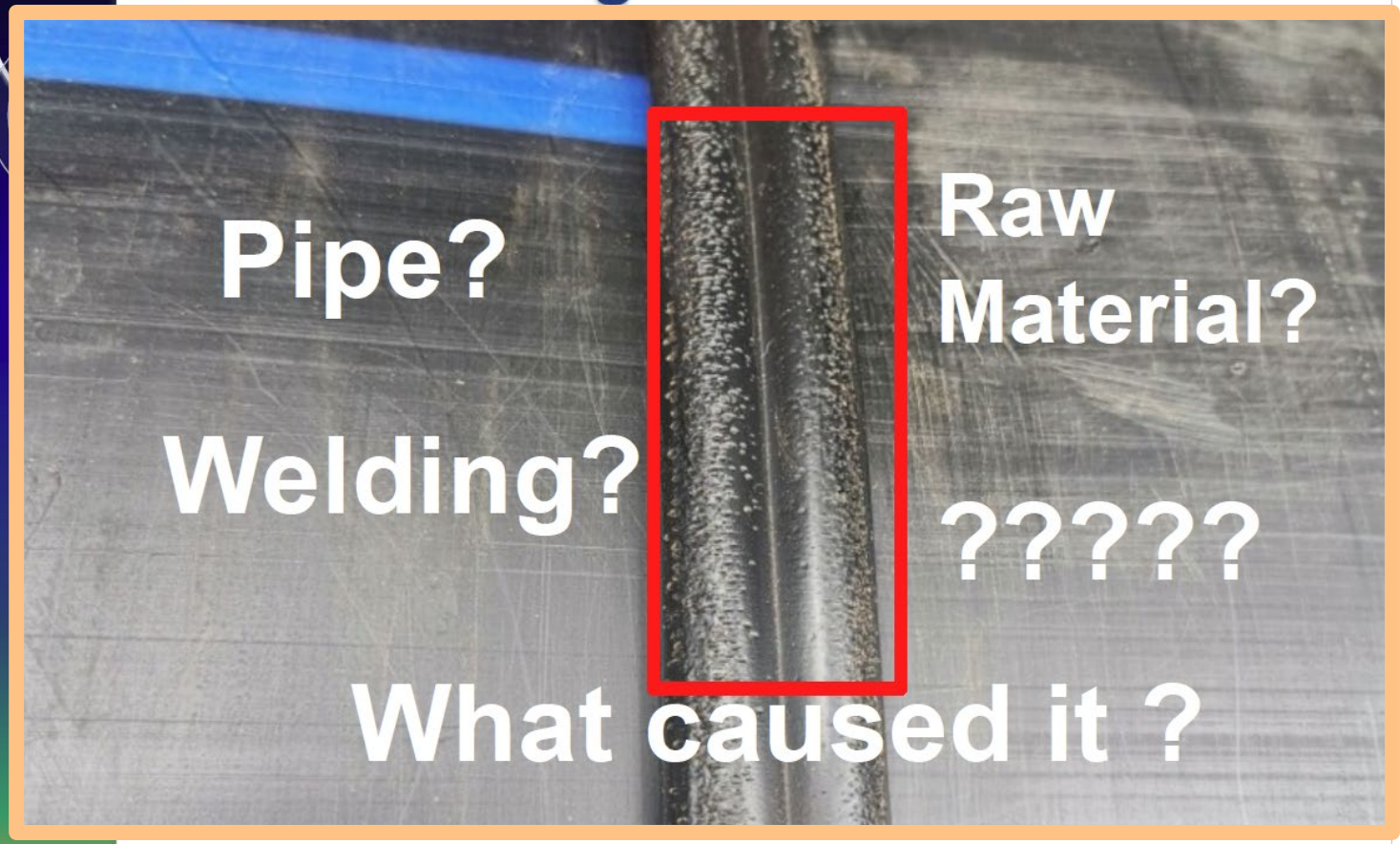
Jointing of PE Pipes and Fittings

Buttwelding SANS 10268-1



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PE 100 DN/OD 450 SDR 13.6

SANS ISO 4427-2

Nominal size DN/OD	Nominal outside diameter de	Mean Outside Diameter		Out of Roundness	13.60	13.60		13.60	
Material	Design stress (σd)	dem min	dem max		Nominal Pressure (PN) Bar				
PE 40	3.20				PN 5	PN 5	PN 5	PN 5	PN 5
PE 63	5.00				PN 8	PN 8	PN 8	PN 8	PN 8
PE 80	6.40				PN 10	PN 10	PN 10	PN 10	PN 10
PE 100	8.00				PN 12.5	PN 12.5	PN 12.5	PN 12.5	PN 12.5
					emin	emax	eave	ID	Kg/m
450.00	450.00	450.00	452.70	15.60	33.10	36.60	34.85	381.65	43.69

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PE100 + Material

BOREALIS

Borouge

INEOS
Olefins & Polymers Europe

IRPC
IRPC Public Company Limited

유화
대한유화주식회사
KOREA PETROCHEMICAL IND. CO., LTD.

lyondellbasell

PetroChina

PRIME POLYMER

sabic

SCG

Sinopec

TASNEE التصنيع

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Reputable Pipe Manufacturer

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Changed raw material suppliers in the middle of the production run

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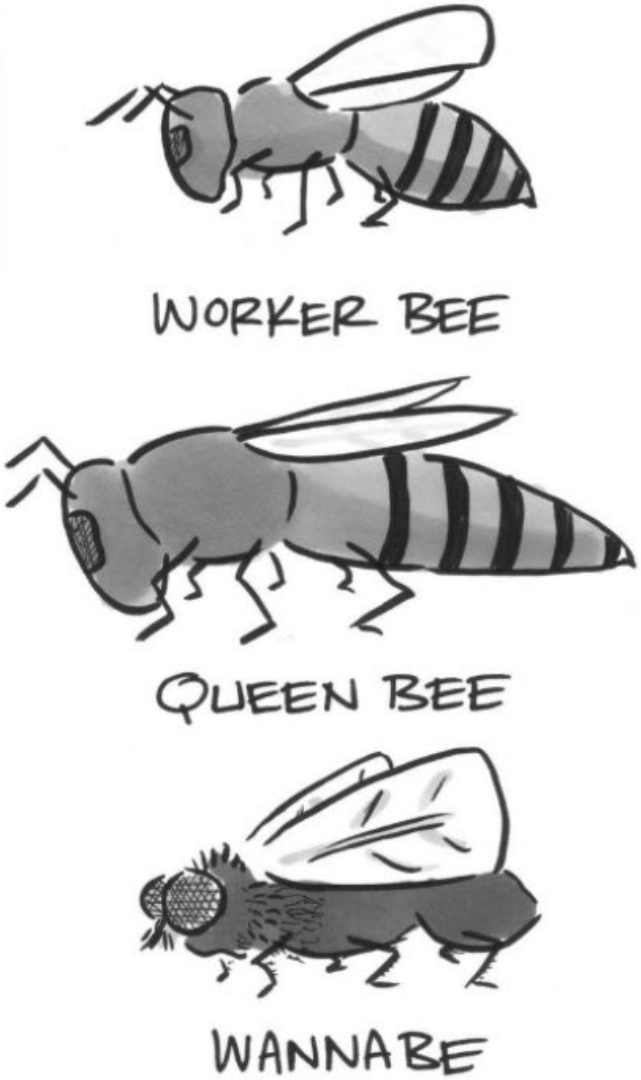
Welding company ? Non-IFPA



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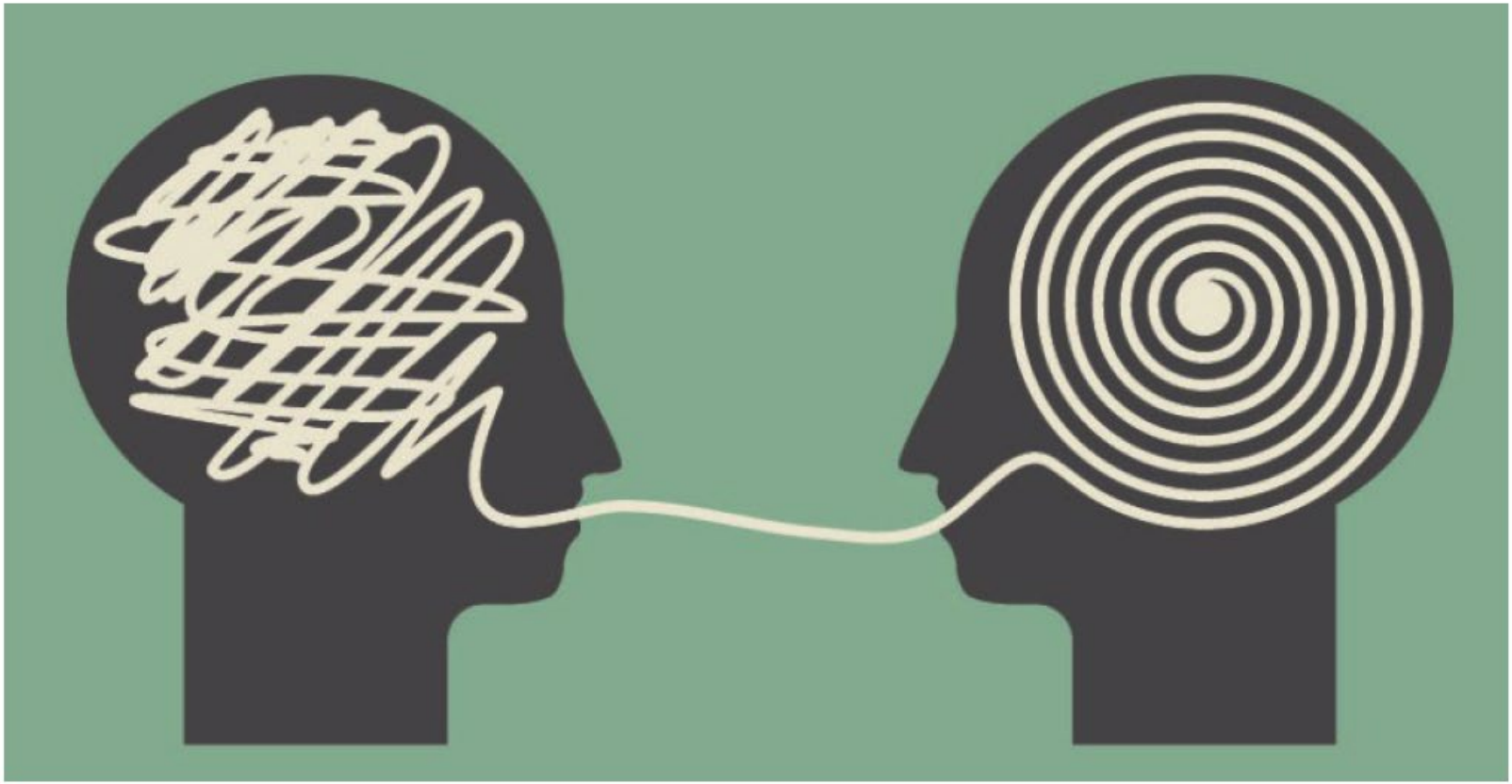
What welder should understand



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What is in the material?

A PE 100 polyethylene normally contains, in addition to the polymer, the following:

- Carbon black, 2-3% which provides some reinforcing effect and UV protection
- Antioxidants, about 0.2% which reduces the risk of degradation during processing and provides long-term protection against oxidation.
- Stearates as a lubricant for easier processing (extrusion) as well as acid scavenger.
- Catalyst residues ($TiCl_4$, $MgCl_2$, Al $(C_2H_5)_3$)
- Possibly also monomers/oligomers

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Butt Welding – Pressure and Force

IFPA Slides Mike Smart

1.1 Difference between pressure and force:

Pressure is Force per unit area - bar; kPa; N/mm²; MPa

Pressures used in Butt Welding - adapting; heating; welding

Calculate - **total force** of welding process

Total Force = Welding Pressure x Pipe CSA --- (i)

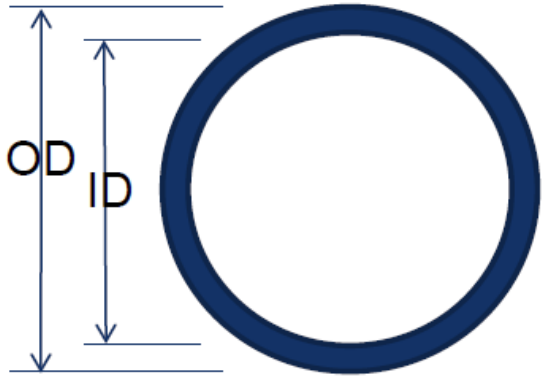
CSA = Contact Surface Area

1.2 CSA of a pipe:

Circle CSA = $\pi D^2 / 4$ --- (ii)

Subtract small circle's CSA from large circle's CSA

Pipe CSA = $\pi (OD^2 - ID^2) / 4$ --- (iii)



Calculation 1.

What's the CSA of 250 mm SDR 17 (PN10) pipe?

From equation (iii) CSA = 11,488 mm²

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Butt Welding – Total force

1.3 Welding pressure for HDPE and PP: - HDPE = 0.15 N/mm²

- PP = 0.10 N/mm²

Calculation 2.

What's the **total force** to weld 250 mm SDR 17 (PN10) HDPE pipe?

From equation (i)

Total Force = Welding Pressure x Pipe CSA --- (i)

= 0.15 X 11,488

= 1,723 N

Total Force to weld pipes comes from welding machine's hydraulic cylinders.

Calculation 3.

If a welding machine has 2 x 25 mm diameter hydraulic cylinders what's their CSA?

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Butt Welding – Machine

From equation (ii)

One cylinder's CSA $= \pi D^2 / 4$ --- (ii)

$= \pi \times 25^2 / 4$

$= 491\ mm^2$

Two cylinder's CSA = $982\ mm^2$

1.4 From Calculation 2: **Total Welding Force = 1,723 N**

From Calculation 3: Cylinder's CSA = $982\ mm^2$

Calculation 4.

What **PGR** (Pressure Gauge Reading) must be set to weld the 250-10 pipe?

PGR = Total Welding Force / Cylinder's CSA

$= 1{,}723 / 982\ N/mm^2$

$= 1.75\ N/mm^2 = 1.75\ MPa = 1{,}750\ kPa = 17.50\ bar$

REMEMBER: Pipe moving friction force must be added to PGR

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Butt Welding – Temperatures

1.5 Welding temperatures:

HDPE:	Lower limit 195° C	– Wall thickness 50 mm
	Upper limit 220° C	– Wall thickness 3 mm
PP:	Lower limit 190° C	– Wall thickness 40 mm
	Upper limit 210° C	– Wall thickness 2.5 mm

NOTE: The thicker the wall the lower the welding temperature.

Adaption pressure = Welding pressure

Heating pressure ("soak pressure") = Welding pressure / 10

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What welder did understand

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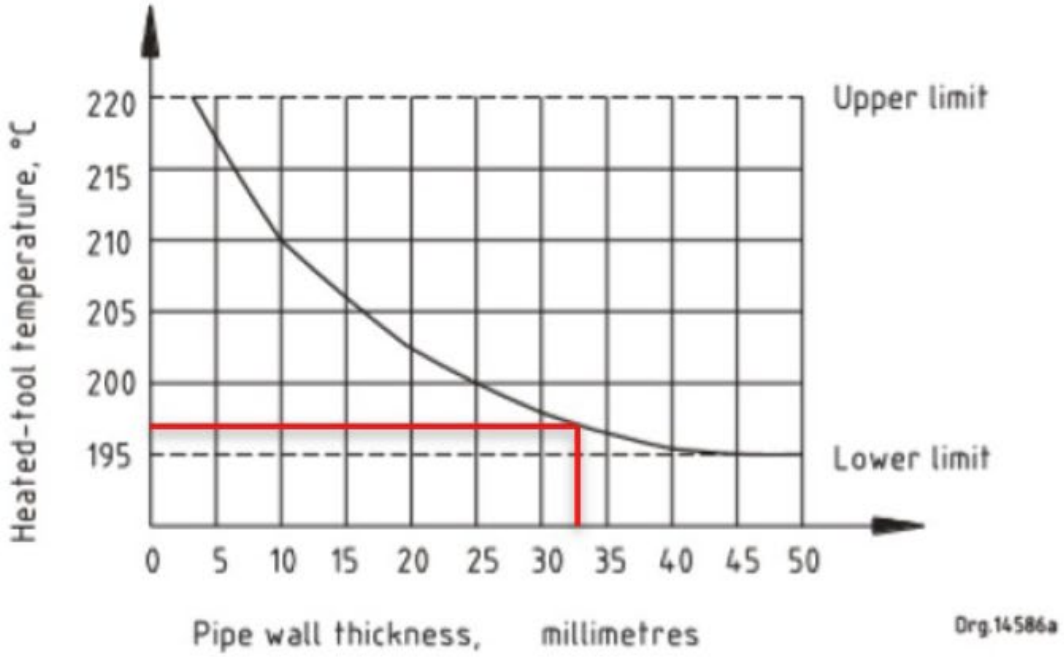
Set the temperature on the welder to 220° C



b) Heated-tool temperature as a function of pipe wall thickness for polyethylene (PE-HD)

Figure 1 — Heated-tool temperature as a function of pipe wall thickness for polypropylene (PP) (top) and polyethylene (PE-HD) (bottom)

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I do not need a P-WPS I have been welding for many years

Table 2 — Recommended values for the heated-tool welding of high-density polyethylene (PE-HD), determined at an ambient temperature of 20 °C and at moderate airflow

1	2	3	4	5	6
Nominal wall thickness	Bead-forming ρ = 0,15 N/mm^2 Height of bead prior to heating period (min. values)	Heating $\rho \leq$ 0,02 N/mm^2 Heating time[a]	Changeover Maximum time	Joining ρ = 0,15 to 0,20 N/mm^2 Time to complete pressure build-up	Total cooling time while under joining pressure
mm	mm	s	s	s	min
Up to 4,5	0,5	45	5	5	6
4,5 to 7	1,0	45 to 70	5 to 6	5 to 6	6 to 10
7 to 12	1,5	70 to 120	6 to 8	6 to 8	10 to 16
12 to 19	2,0	120 to 190	8 to 10	8 to 11	16 to 24
19 to 26	2,5	190 to 260	10 to 12	11 to 14	24 to 32
26 to 37	3,0	260 to 370	12 to 16	14 to 19	32 to 45
37 to 50	3,5	370 to 500	16 to 20	19 to 25	45 to 60
50 to 70	4,0	500 to 700	20 to 25	20 to 35	60 to 80

[a] For PE-HD, the heating time, in seconds, is approximately 10 times the wall thickness, in millimetres.

NOTE Less than wall thickness 4,5 mm will result in an increase in the risk factor for weld failure and care should be taken with regard to the substance being carried by the completed installation. If the installation is to carry dangerous substances, other welding methods should be considered.

What is actual temperature at 200° C

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What does the weld look like at 196° C

We have selected one pipe made on 02 08 19, 22.39. Cut the pipe at one point and welded it at that position to observe the welding. 11:51 pm

Though the trial is still continuing, the results so far speaking for itself. 11:52 pm

1) the first weld was done with 196 degrees hot plate temperature (this is the recommended temperature for this size with wall thickness of 34mm) 11:53 pm

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What does the weld look like at 228° C vs 196 °C

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Lessons Learnt

All aspects related to the pipe system is of importance

Raw Materials, Pipe, Fittings and Jointing

All processes and procedures as per the standards are of importance

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SANS 10268-10 Weld defects

4 Requirements

4.1 Welded joints

Requirements for welded joints shall be specified in any documentation that can be binding on the manufacturer, for example, working drawings or welded diagrams. As a rule it should be sufficient to identify a weld as per the following example:

WZ-V-II

where

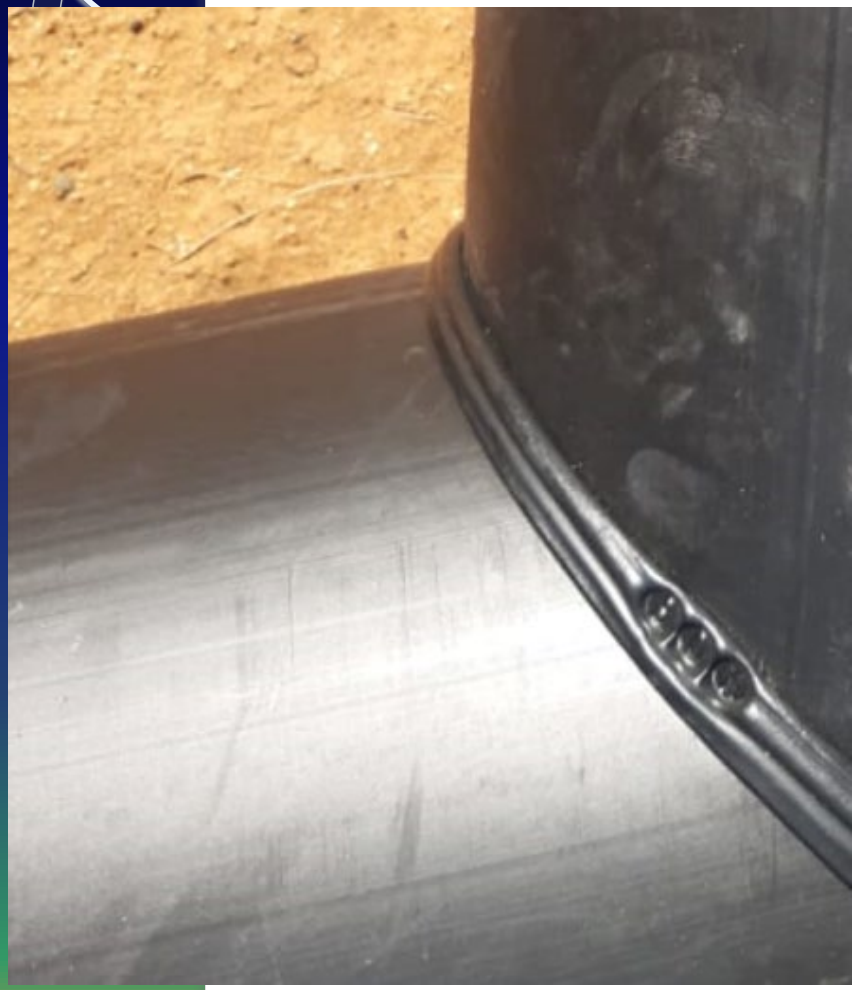
WZ is the welding process;

V is the welding symbol and measurements; and

II is the evaluation group code.

If the tables contained in this part of SANS 10268 are used, the requirements for assessing a welded joint with respect to a particular quality class can be readily determined. By checking systematically through individual features (i.e. the type and extent of the faults), it is possible to undertake the evaluation of the welded joints as part of the acceptance procedure for the welded component or system.

SANS 10268-10 Continue



4.2 Weld characteristics

The requirements for weld characteristics should cover all additional data such as:

a) deformation resistance, for example, the welding factor;

b) plasticity, for example, bending angle or cracking; and

c) resistance to chemical attack, i.e. the resistance factor.

4.3 Aftertreatment

In certain cases, it might be necessary to apply a finishing process, such as machining, to the completed weld joint. This could be required where dynamic stresses occur to ensure notch-free transitions, and also:

a) to smooth weld surfaces (for example, tank linings);

b) to improve flow behaviour (for example, removal of internal weld beads in pipes); and

c) for technical inspection reasons.

In such cases it is advisable that the weld be tested and evaluated both before and after machining.

SANS 10268-10 cont

4.4 Examination and testing

Visual examination and testing of welded joints shall comply with the requirements of SANS 6269.

5 Materials

5.1 This part of SANS 10268 applies to welded joints on components and systems made from the following materials:

a) high-density polyethylene (PE-HD) (also known as rigid PE);

b) polypropylene block copolymer (PP-B);

c) polypropylene homopolymer (PP-H);

d) polypropylene random copolymer (PP-R);

e) chlorinated poly(vinyl chloride) (PVC-C);

f) high-impact poly(vinyl chloride) (PVC-HI);

g) unplasticized poly(vinyl chloride) (PVC-U) (also known as rigid PVC);

h) polyvinylidenefluoride (PVDF); and

i) acrylonitrile butadiene styrene terpolymer (ABS).

Table 4 — Minimum requirements for the tensile welding factor f_z

1	2	3	4	5	6
Welding process	**Tensile welding factor f_z**				
	PE-HD	**PP**	**PVC-C**	**PVC-HI PVC-U**	**PVDF**
Heated-tool welding	0,9	0,9	0,8	0,9	0,9
Extrusion welding	0,8	0,8	–	–	–
Hot-gas welding	0,8	0,8	0,7	0,8	0,8
Electrofusion welding	0,9	0,9	–	–	–
Solvent welding	–	–	0,8	0,9	0,9

5.2 The use of this part of SANS 10268 for the approval or rejection of welds made on thermoplastics other than those listed in 5.1 shall be agreed upon between the manufacturer and the purchaser.

Assessment

3 Description of the spigot end fitting

The manufacturer's technical file shall include the information, as described in Tables 1 and 2, for the identification of the fitting and the PE compound used.

Table 1 — Identification of the fitting

Name of the manufacturer	
Trade mark of the fitting	
Type of fitting (tee, elbow, reducer, etc.)	
Application, e.g. water and gas	
Detailed explanation of the identification coding of the fitting	
Nominal diameter(s) and SDR	
Compliance with product standard(s)	

Table 2 — Characteristics of the PE compound

Trade mark	
Classification of compound in accordance with ISO 12162, e.g. PE100	
Compound code in accordance with ISO 12176-4	
Melt mass-flow rate, e.g. MFR(190/5) indicating temperature and load used in the test, in accordance with ISO 1133, of the compound and tolerances, if not provided by the product standard	
Colour of the compound	

4 Geometrical characteristics of the fitting

The manufacturer's technical file shall provide all relevant dimensions in millimetres. At a minimum, the dimensions related to the symbols shown in Figure 1 and Table 3 shall be provided.

The dimensions used in Table 3 are in conformity with the relevant product standard.

The dimensions shown in Figure 1 and Table 3 are the following:

D_1 the mean outside diameter of the fusion end-piece, measured in any plane parallel to the plane of the mouth and at a distance not greater than L_2 from that plane;

D_2 the mean outside diameter of the body of the fitting;

D_3 the minimum bore which comprises the minimum diameter of the flow channel through the body of the fitting. This diameter does not include the fusion bead if any;

E the thickness of the fitting measured at any point on the wall of the fitting;

E_s the thickness of the fusion-face wall, measured at any point at a maximum distance, L_1 (cut-back length) from the mouth;

L_1 the length of the cut-back section of the fusion end-piece, which comprises the initial depth of the spigot and which is necessary for butt fusion or electrofusion;

L_2 the tubular length, which comprises the length of the initial, tubular, section of the fusion end-piece;

L overall dimensions of the fitting defined by the manufacturer;

Ovality out-of-roundness (ovality) of D_1 measured at any point of L_1

6 Assessment classes

6.1 Classification

Specific requirements for load-carrying capacity and the safety requirements for the commodity being carried by the welded joints in various piping systems are given in SANS 791, SANS 966-1, SANS 967, SANS 15874-3, SANS 4427-3 and SANS 10112. **Amdt 1; amdt 3**

The following table of assessment classes shall be used as a basis for designers, manufacturers and inspectors, to be able to determine the measures required for the necessary quality control of the welding processes.

Table 1 — Measures required for quality control

1	2
Assessment class	**Requirement level**
I	High requirements for safety or for load-carrying capacity, or for both
II	Medium requirements for safety or for load-carrying capacity, or for both
III	Low requirements for safety or for load-carrying capacity, or for both

6.2 Criteria for allocation of assessment class

When requirements for specific welded joints are drawn up, they should be appropriate for the local situation or the specific application (i.e. cognizance should be taken of the commodity to be conveyed).

In the allocation of assessment classes, the following factors shall be considered:

a) the type of stress to which the system will be subjected during operation (for example, static or dynamic);

b) the material to be welded (for example, viscous or brittle);

c) the operating conditions under which the system will work (for example, static or changing);

d) the production site and conditions (for example, workshop, construction site or welding position); and

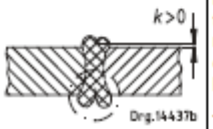
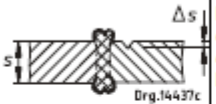
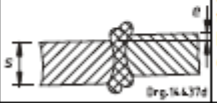
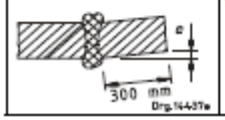
e) the potential danger presented by the commodity to be conveyed (for example, gases, fluids that are dangerous when mixed with water, etc.).

6.3 Assessment

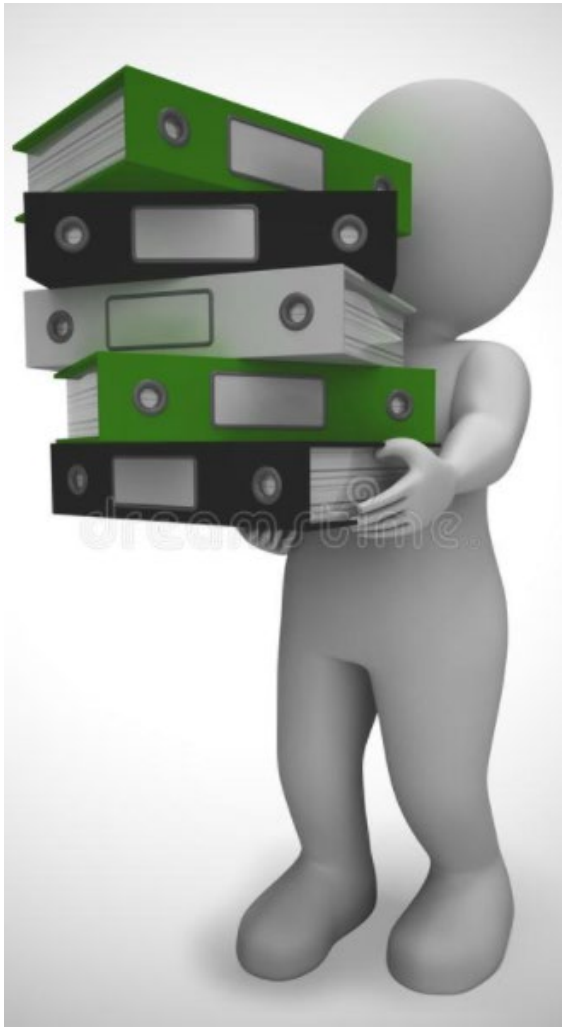
The test results obtained in accordance with 4.4 shall form the basis for the classification of welded joints into one of the three assessment classes in accordance with the appropriate table supplied in this part of SANS 10268. These results shall be used to determine points where the requirements are not complied with. Should the component or welded joint not correspond to the assessment class specified, then it will be deemed to be a reject. (See also 6.4.)

8 Assessment tables

Table 2 — Description of assessment classes for heated-tool butt welding (HS) — External quality of joint

1	2	3	4	5
Type of fault	Description	Assessment class		
		I	II	III
1 Cracks 	Cracks running length-wise or crosswise to weld, and located: – in the weld; – in the base material; or – in the heat-affected zone	Not permissible	Not permissible	Not permissible
2 Bead notches 	Continuous or local notches lengthwise to weld with notch root in base material, caused, for example, by: – insufficient joint pressure; – warming-up time too short; or – cooling time too short	Not permissible	Not permissible	Not permissible
3 Notches and flutes 	Notches in the edge of the base material, lengthwise or crosswise to weld, caused, for example, by: – clamping tools; – incorrect transport; or – faulty edge preparation	Locally permissible if ending of notch is flat and $\Delta s \leq 0{,}1s$, with a maximum of 0,5 mm	Locally permissible if ending of notch is flat and $\Delta s \leq 0{,}1s$, with a maximum of 1 mm	Locally permissible if ending of notch is flat and $\Delta s \leq 0{,}1s$, with a maximum of 2 mm
4 Mismatch of joint faces 	Joint faces are misaligned relative to one another, or thickness variations have not been corrected	Permissible if $e \leq 0{,}1s$, with a maximum misalignment of 2 mm	Permissible if $e \leq 0{,}15s$, with a maximum misalignment of 4 mm	Permissible if $e \leq 0{,}2s$, with a maximum misalignment of 5 mm
5 Angular deflection 	Caused by machine fault or layout fault	Permissible if $e \leq 1$ mm	Permissible if $e \leq 2$ mm	Permissible if $e \leq 4$ mm

SANS 10268-10



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Faults will happen. What then ?

6.4 Overlapping faults

Should two or more types of faults occur simultaneously in a welded joint, the detrimental effect that each individual fault has on the weld could be increased systematically. Tests should then be carried out to ascertain whether the welded joint still meets the requirements specified or whether restrictions should be placed on the component or on the assembled system with regard to safety and quality standards. In certain circumstances, the component or system might have to be re-classified into another assessment class, depending upon mutual agreement between the manufacturer and the purchaser.

7 Acceptance of components or systems

If tests on a component or system confirm that the requirements specified have been met, the component or system shall be deemed to comply with the requirements.

Where the requirements are not met, and corrective action is not possible, the manufacturer shall produce a special document that specifies the usability of the component or system in comparison with the requirements of the original specification.

In this case, acceptance or rejection shall be as agreed upon between the manufacturer and the purchaser.

Questions and Answers

Ian Venter

24-03-2021

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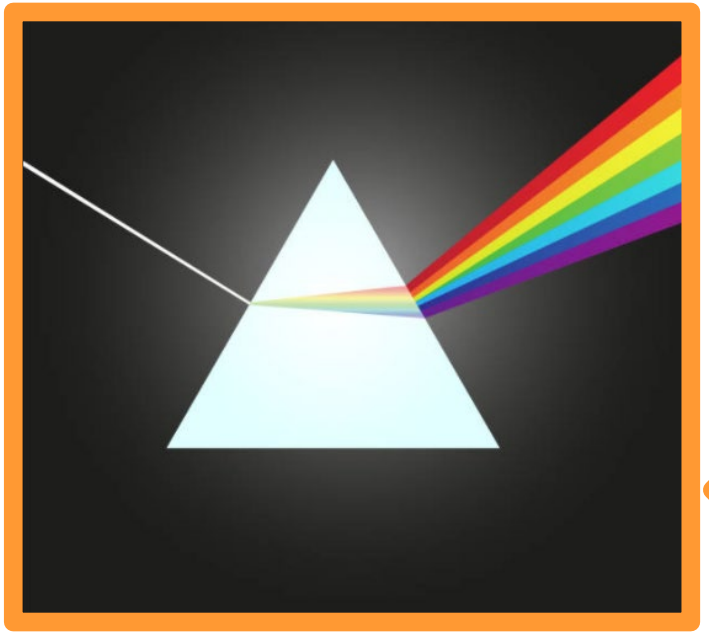
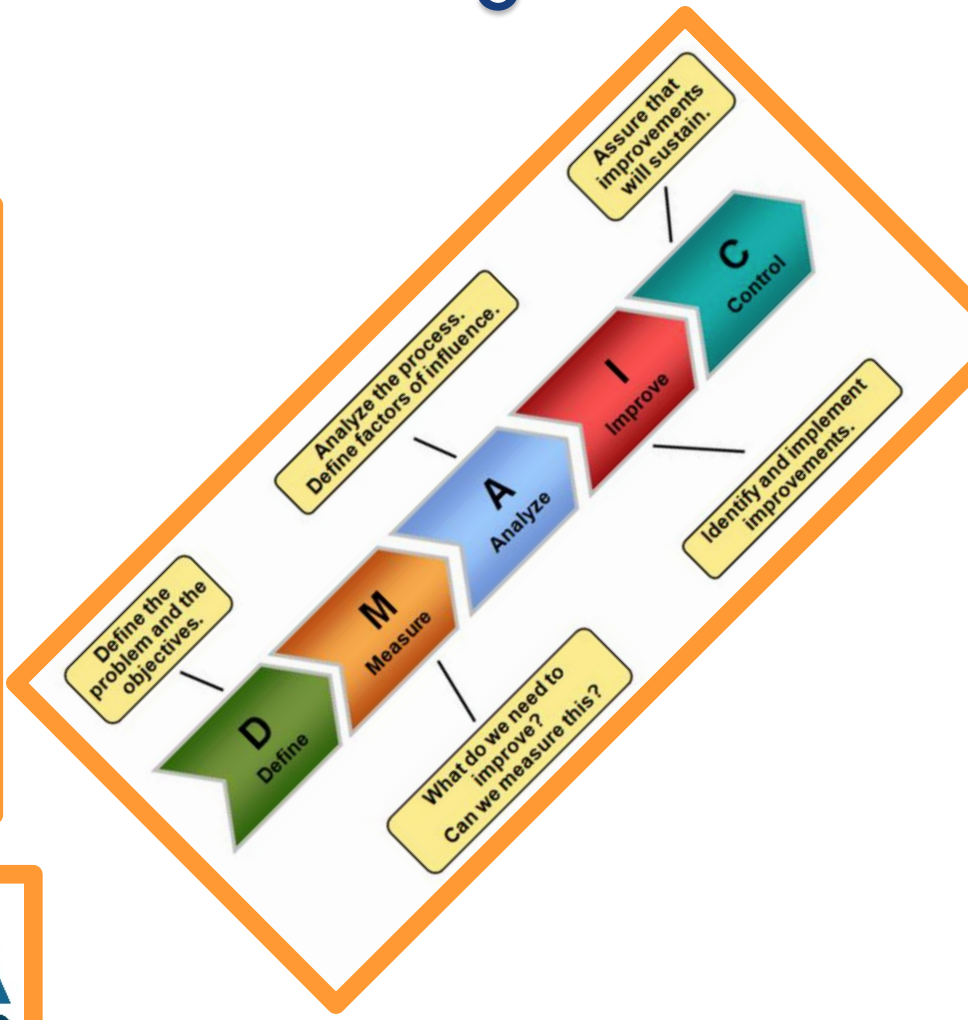
Understanding the importance of Jointing Standards leads to growth





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SAPPMA Webinar II

24 March 2021

Questions and Answers

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