SIFFO® STEEL WIRE SKELETON REINFORCED HDPE PIPE (SRPE) & FITTINGS WELDING & HYDRO TEST GUIDANCE

Location: Laboratory in the SIFFO SRPE factory
Date: October 09, 2025 to October 12, 2025

Test Products : DN250 10'' PN25 SRPE Pipe, DN250 10'' PN25 Coupling, DN250 10''PN25 45 degree SRPE Elbow,DN250 10'' PN25 90 degree Elbow.

Background:

SIFFO HDPE steel wire mesh composite reinforced pipe (SRPE pipe) is a composite pipe with a high-strength steel wire mesh as the skeleton and inner and outer layers covered with HDPE (high-density polyethylene). It combines the high strength of steel with the corrosion resistance and flexibility of HDPE, and is widely used in municipal water supply and drainage, gas transmission, and industrial fluid transportation. Electrofusion welding is the core and most reliable connection method for this pipe. Its principle is that an electric heating wire built into the electrofusion fitting heats up simultaneously, melting the inner wall of the fitting and the outer wall of the pipe. After pressure holding and cooling, an integrated sealed joint is formed.

This guide is based on relevant industry standards (GB/T 32439-2015 "Steel Wire Mesh Reinforced Plastic Composite Pipe" and GB/T 19809-2005 "Plastic Pipes and Fittings - Determination of Tensile Strength and Bursting Pressure of Electrofusion Welded Joints of Polyethylene"), and details the preparatory work, operating procedures, quality inspection, precautions, and common problem handling methods for electrofusion welding of HDPE steel wire mesh reinforced pipes. It aims to provide standardized and regulated technical guidance for on-site construction to ensure welding quality and safe operation of the pipeline network.

Guidance Details

1. Welding preparation

1.1 Tools:

1	Electrofusion Welding Welding Machine (Mode: HJ350,same welding machine with site),	
2	Grinder with flap disc	
3	1.0t Chain puller	
4	Hammer	
5	Alcohol	

1.2 Power: 220V AC

1.3 Welding Parameters

The welding parameters of the fittings in this test are 100% same with the site. The detailed parameters are below

1	SRPE Coupling DN250 PN25	1st Phase: 35V ,200S 2nd Phase: 40V ,300S 3rd Phase: 46V ,400S or 1st Phase: 35V ,200S 2nd Phase: 40V ,300S 3rd Phase: 0V ,120S 4th Phase: 46V ,400S	
2	SRPE 90DEG Elbow DN250 PN25	1st Phase: 25V ,200S 2nd Phase: 30V ,300S 3rd Phase: 0V ,100S 4th Phase: 35V ,250S	
3	SRPE 45DEG Elbow DN250 PN25	1st Phase: 25V ,200S 2nd Phase: 30V ,300S 3rd Phase: 0V ,100S 4th Phase: 35V ,250S	
Remark: The welding parameter of DN250 PN25 45&90 Deg elbow and Tee are same,elbow welding test is enough for verify the accuracy of welding parameters.			

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Coupling

45 DEG Elbow

90DEG Elbow

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1.4 Oxide layer polishing

First, measure the socket depth between the pipe fitting and the pipe, mark the scale line, and gently grind the pipe surface with a flap angle grinder to remove the surface oxide layer and make the surface rough.

1.4.1 Tools: Flap Disc Angle Grinder

1.4.2 Start to polish

1.4.3 Polishing completed

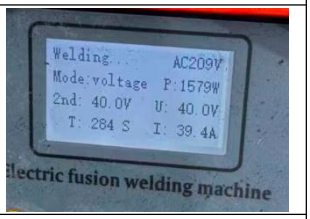
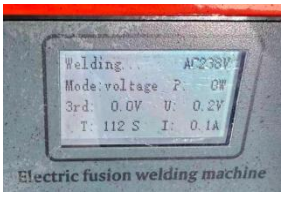
1.5 Socket installation

Socket-and-socket installation requires a chain puller, hammer, and wooden planks. During installation, ensure the fittings and pipes are aligned straight and free of angles. Otherwise, internal stress will build up between the fittings and pipes, leading to welding failure.Use two sets of chain pullers to fix them on both sides of the pipe, apply force evenly, and tighten the pipe and fittings to make them fully socketed.

2. Welding

Electrofusion Welding Machine	Welding Machine Model: HJ 350 Rated Power: 3.5KW Rated Input Voltage: AC220V Output Voltage: DC3-70V Output Current: DC3-60A Mode: Constant voltage mode	

2.1 Coupling Welding

Phase No.	Welding Parameter	Accurate Power	Photo
1	35V ,200S	Input Voltage: AC210±10V Output Voltage: DC 35V±0.3V	
2	40V ,300S	Input Voltage: AC210±10V Output Voltage: DC 40V±0.3V	
3	0V ,150S	Input Voltage: AC220+20V Output Voltage: DC 0+0.3V	
4	46V ,400S	Input Voltage: AC210±10V Output Voltage: DC 46V±0.3V	
Remark	1.The coupling welding can be done in three or four steps. If using a four-step process, set the voltage to 0 in the third step, it is pausing welding for about 100-120 seconds. If the temperature is high, a brief pause to cool		

	down can improve welding quality. A three-step process is also acceptable,there's not much difference. 2. At third stage, because the welding voltage is not set for the welder, the welder is no–load and has no load, so the input voltage will be high.

2.2 Pressure Holding and Cooling

1. Pressure Holding Requirements: After welding, keep the pipes and fittings fixed in place, and do not remove the cable joints (to prevent air from entering the welding area and affecting the molten quality). The pressure holding time should be ⩾ 1.5 times the welding time (e.g., if the welding time is 60 seconds, the pressure holding time should be ⩾ 90 seconds).

2. Cooling Requirements:

- Use natural cooling. Water cooling, forced air cooling (such as direct fan blowing), or other accelerated cooling methods are strictly prohibited to avoid cracking and embrittlement of the joint due to excessive temperature differences, which would reduce the joint strength.

- Cooling time is determined according to the pipe diameter. Reference values: DN50-DN110 pipes: ⩾ 30 minutes; DN160-DN200 pipes: ⩾ 60 minutes; DN250 and above pipes: ⩾ 90 minutes. Final cooling standard: Touch the surface of the fitting; it should feel cool to the touch, and the temperature should be close to ambient temperature.

3. Post-cooling treatment: After cooling to the required standard, first remove the welding machine cable joint, and then remove the pipe fixing device; handle gently during the removal process to avoid collisions or dragging of the pipes and fittings to prevent damage to the joints.

3. Quality Inspection

3.1 Appearance Inspection (100% Full Inspection)

1. Basic Appearance: Observe the overall appearance of the welded joint. The pipe fittings should be free of damage, cracks, and deformation. The connection between the pipe and fittings should be tight, with no obvious gaps. The surface of the fittings should

be free of charring, carbonization marks, residual oil, and impurities.

2. Welding Area Inspection:

- Check the joint between the fittings and the pipe for uniform molten material overflow (overflow width 2-5mm, uniform thickness, no gaps). The overflow should be translucent or milky white, without bubbles or impurities (uneven overflow or no overflow may indicate insufficient welding temperature or insufficient insertion depth).

- Check the pipe insertion depth to ensure the pipe end face is flush with the fitting stop or reaches the marked insertion depth. The insertion depth deviation should be ≤±2mm.

4. Handling of Non-conforming Joints: If any non-conformity is found during appearance inspection (such as cracks, charring, abnormal overflow, insufficient insertion depth, etc.), the joint is deemed non-conforming and must be immediately cut off and re-welded.

3.2 Hydro Pressure Test (Sampling Inspection or 100% Inspection)

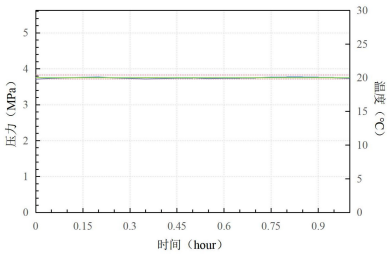
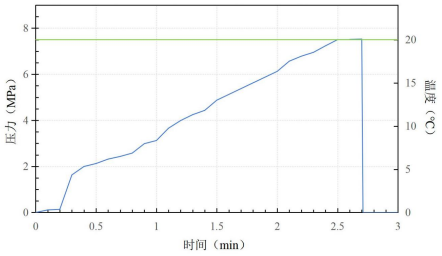
1. Test Conditions: The pressure test can only be conducted after the welded joint has completely cooled (the cooling time must meet the requirements of Clause 3.6.2 of this guide); the test medium is clean water (air, oxygen, and other gases are strictly prohibited as test media to avoid the risk of explosion).

2. Test Procedure:

- Connect the pipe section to be tested to the pressure testing system, install a pressure gauge (accuracy ≥ 0.4) and an exhaust valve; close the exhaust valve, and slowly increase the pressure to the test pressure (test pressure = 1.5 times the nominal pressure

of the pipe, and not less than 0.6 MPa), with a pressure increase rate ≤ 0.1 MPa/minute.

Taking the 2.5 MPa pressure-rated SRPE pipes and fittings in this test as an example, the hydrostatic test requires maintaining a pressure of 3.75 MPa. The burst pressure is three times the working pressure, meaning the minimum pressure at which the SRPE can be damaged is 7.5 MPa.

Test Name	Image	Test result
Hydrostatic test under 3.25Mpa Hydro pressure		
Burst Pressure test under 7.5Mpa Hydro pressure		
Note: At a water temperature of 25 C degree		

- After increasing the pressure to the test pressure, close the pressure-increasing valve and stabilize the pressure for 30 minutes; during the pressure stabilization process, observe the changes in the pressure gauge reading and whether there is any leakage at the welded joint (soapy water can be applied to the joint to observe whether bubbles are generated).

- After pressure stabilization, reduce the pressure to the nominal pressure of the pipe and continue stabilizing for 1- 2 hours. During this period, check again for leaks at the joints

and for any pressure drop; if no leaks are found, the test is considered qualified.

3. Handling of Non-conforming Joints: If a pressure drop or joint leakage occurs during pressure testing, immediately release the pressure and locate the leak point. Cut off the non-conforming joint, re-weld it, and conduct the pressure test again until it passes.

4.Common problems and solutions

Problems	Why and Analysis	Solution
Leakage at the welded joint (pressure test failed)	1. Incomplete scraping of the pipe's outer wall, failure to remove the oxide layer, and weak fusion bonding; 2. Improper welding parameters (unstable power supply, voltage too low, welding time too short), resulting in insufficient melting; 3. Excessive gap between the pipe and fittings during assembly, and failure to use sealant; 4. Displacement of the pipe and fittings during welding, generating internal stress.	1. Cut off any defective joints and re-scrape and clean the pipe, ensuring thorough scraping; 2. Confirm and input the correct welding parameters, adjusting them according to the ambient temperature; 3. Ensure the welding voltage is stable and meets the standards. 4. The pipe ends must be completely sealed using PE sealing electrodes to prevent the steel wire from being exposed; 5. Strengthen the fixation after assembly to ensure no displacement of the pipe and fittings during welding; perform a pressure test after re-welding.
Smoke and fire during pipe welding	1. Improper welding parameters (excessive voltage, excessive time), resulting in over-melting; 2. Damaged or short-circuited heating wire in the fitting; 3. Insufficient gap between the pipe and fitting, preventing heat dissipation; 4. Incomplete cleaning, leaving residual oil and	1. Immediately stop the machine, disconnect the power, and cease welding; 2. Check the welding parameters to confirm they meet the pipe fitting requirements. Contact the manufacturer for verification if necessary; 3. Inspect the pipe fittings for damage and replace any damaged fittings;

	impurities that burn during welding; 5. Too much oxygen inside the pipe, making the heating point flammable.	4. Clean the pipes and fittings thoroughly, ensuring they are free of oil and impurities; adjust the assembly gaps and re-weld. 5. When re-welding, plug the pipe opening.
No overflow or very little overflow after welding.	1. Insufficient welding temperature or time, resulting in insufficient molten material; 2. Insufficient pipe insertion depth, failing to cover the heating wire area; 3. Excessive gap between the pipe and fitting, with no excess overflowing after the molten material fills the gap; 4. Excessive scraping, resulting in an insufficient PE layer on the outer wall of the pipe and inadequate molten material.	1. Confirm welding parameters and extend welding time appropriately (must meet manufacturer requirements); 2. Recheck pipe insertion depth to ensure it meets the standard; 3. Check assembly clearance; apply sealant if clearance is too large; 4. Control scraping depth to avoid excessive scraping; check for overflow after re-welding.
The welded joint fractured at the joint during a tensile test.	1. Insufficient melting, resulting in incomplete bonding between pipes and fittings; 2. Incomplete scraping, with the oxide layer affecting bond strength; 3. Displacement during welding, leading to uneven stress on the joint; 4. Substandard fitting quality, with uneven distribution of heating wires.	1. Inspect the scraping, welding parameters, assembly and fixing processes, and rectify any problems found; 2. Inspect the quality of the pipe fittings to confirm whether they are qualified products; 3. Re-weld the joints and conduct tensile tests on samples until they pass; 4. If the problem is with the pipe fittings, immediately stop using that batch of fittings and contact the manufacturer for handling.