

## Steel Wire Reinforced Polyethylene Composite Pipe

Double-sided anti-corrosion, good temperature resistance, small thermal expansion coefficient

Uniform and reliable composite of steel and plastic materials

Good creep resistance, long-lasting high mechanical strength

Special electrofusion joints, various types, very fast and reliable installation

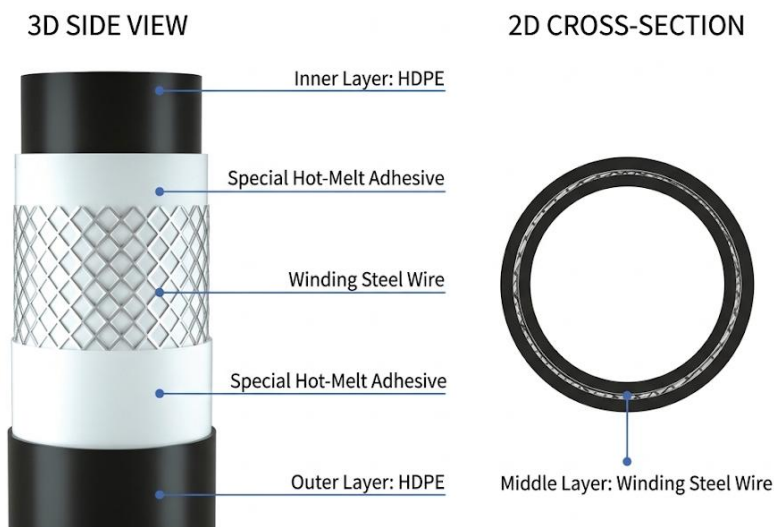
Good rigidity, impact resistance, and dimensional stability, combined with moderate flexibility, combining rigidity and flexibility

## Steel Wire Mesh Reinforced Polyethylene Composite Pipe Series

### Product Introduction

Steel wire mesh skeleton composite pipe (GB/T 32439, abbreviated as SRCP pipe) is a new type of composite structure wall pressure pipe. It uses high-strength steel wire and high-density polyethylene (HDPE) plastic as raw materials. A spirally formed mesh skeleton serves as the reinforcing core layer, while HDPE forms the inner and outer layers of the pipe. A high-performance adhesive resin layer firmly connects the steel wire mesh skeleton with the inner and outer HDPE layers to form a monolithic pipe wall.

### STEEL WIRE REINFORCED HDPE PIPE STRUCTURE



The addition of the steel wire reinforcing mesh to the composite pipe not only greatly improves its pressure resistance compared to solid wall PE pipes but also retains the excellent corrosion resistance and scale-free characteristics of solid wall PE pipes. The reinforcement is encapsulated in continuous thermoplastic plastic, ensuring the isolation of the steel wire from the

external environment, thereby extending the service life of the steel wire and guaranteeing the long-term pressure resistance of the pipe.

The adhesive resin is a high-performance bonding material, a modified HDPE material that can completely melt and integrate with HDPE under heating conditions. At the same time, its polar bonds have strong bonding properties with steel. The use of the adhesive resin successfully solves the problem of lacking a connection factor between steel and HDPE, resulting in a more excellent composite effect. The steel wire mesh winding forming method gives the composite pipe a low linear expansion coefficient while maintaining a certain degree of flexibility in the axial direction, giving it strong environmental adaptability. This pipe is widely used in the water supply field and is a new type of practical pipe.

### **Performance Advantages**

The steel wire mesh skeleton composite pipe shares the common characteristics of plastic pipes, such as anti-corrosion, non-scaling, smooth surface with low resistance, heat preservation without wax accumulation, wear resistance, and light weight. Moreover, its unique structure endows it with the following features:

#### **• Good creep resistance, long-lasting high mechanical strength**

Because plastics will creep under normal temperature and stress, and brittle fracture will occur under high continuous stress, the allowable stress and pressure bearing capacity of pure plastic pipes are very low (generally within 1.0Mpa). The mechanical strength of steel is about 10 times that of thermoplastics, and it is very stable within the temperature range of plastics without creep. After compounding the reticulated steel wire skeleton with plastic, the steel wire mesh skeleton can effectively restrain the creep of the plastic, thus greatly improving the long-term strength of the plastic itself. Therefore, the allowable stress of the steel wire mesh skeleton composite pipe is doubled compared to that of the plastic pipe.

#### **• Good temperature resistance**

The strength of plastic pipes within their operating temperature range generally decreases as the temperature increases. For every 10°C increase in temperature, their strength decreases by about 10% or more. Since about 2/3 of the strength of the steel wire mesh skeleton composite pipe is borne by the steel wire mesh skeleton, the degree to which its strength decreases with an increase in operating temperature is lower than that of any pure plastic pipe. Experimental results show that for every 10°C increase, the strength of the steel wire mesh skeleton composite pipe decreases by less than 5%.

#### **• Good rigidity, impact resistance, and dimensional stability, combined with moderate flexibility, combining rigidity and flexibility**

The elastic modulus of steel is usually about 200 times that of high-density polyethylene. Due to the strengthening effect of the steel wire mesh skeleton, the rigidity, impact resistance, and dimensional stability of the steel wire mesh skeleton composite pipe are superior to any pure plastic pipe. At the same time, because the reticulated steel skeleton itself is a flexible structure, the composite pipe also has a certain flexibility in the axial direction. Therefore, this pipe features a combination of rigidity and flexibility, demonstrating excellent adaptability in loading, unloading, transportation, and installation, as well as operational reliability. Above-ground installation can

save on the number of supports, resulting in low costs; underground installation can effectively withstand sudden impact loads caused by settlement, sliding, vehicles, etc. Small-diameter pipes can be properly bent, laid out along undulating terrain or in a serpentine arrangement, saving on fittings.

#### Small thermal expansion coefficient

Since the linear expansion coefficient of the steel wire used in plastic pipes is  $10.6\sim 12.2\times 10^{-6}(1/^{\circ}\text{C})$ , and the linear expansion coefficient of pure plastic pipes is  $170\times 10^{-6}(1/^{\circ}\text{C})$ , the thermal expansion property of the composite pipe is greatly improved under the constraint of the reticulated steel skeleton, which is lower than that of any commonly used plastic pipe. Through testing, the expansion coefficient of the steel wire mesh skeleton composite pipe is  $35.4\sim 35.9\times 10^{-6}(1/^{\circ}\text{C})$ , which is only 3~3.4 times that of ordinary carbon steel pipes. Experimental results show that when buried, thermal compensation devices are generally not required. The pipe can be laid in a meandering manner to absorb (or release) thermal expansion, thereby reducing installation costs.

#### • Rapid crack propagation will not occur

Pure plastic pipes, especially large-diameter pure plastic pipes, are prone to rapid crack propagation (instantaneously spreading over hundreds of meters to over a kilometer) caused by local defects and stress concentration under the action of long-term hoop stress at low temperatures. Therefore, there are high requirements for the rapid crack propagation resistance of pipe plastics internationally. Low-carbon steel does not have the problem of brittle fracture, and the presence of the steel mesh prevents the deformation and stress of the plastic from reaching the critical point that causes rapid crack propagation. Therefore, theoretically speaking, there is no rapid crack propagation in steel wire mesh skeleton composite pipes.

#### • Uniform and reliable composite of steel and plastic materials

The steel-plastic composite pipes currently on the market are prone to delamination under the action of alternating stress during long-term use because the composite interface between steel and plastic is continuous and regular, leading to leakage at the connections and failure due to bottleneck-like shrinkage and blockage internally. In contrast, the steel wire mesh skeleton composite pipe has a mesh structure that tightly combines the plastic and the steel wire mesh into an integrated whole through a special hot melt adhesive (modified HDPE). The mutual restraining force between the two materials is large and uniform, resulting in small stress concentration.

#### • Double-sided anti-corrosion

The steel wire mesh skeleton is composited within the plastic through a special hot melt adhesive layer. The inner and outer surfaces of the pipe have the same anti-corrosion properties and wear resistance. The inner wall is smooth, with low conveying resistance, no scaling, and no wax accumulation, resulting in obvious energy-saving effects. It is more economical and convenient for buried conveying and under corrosive environmental conditions.

#### • Special electrofusion joints, various types, very fast and reliable installation

The steel wire mesh skeleton composite pipe is connected using either electrofusion connection or flange connection. Electrofusion connection involves inserting the composite pipe into an

electrofusion fitting and electrifying the heating wire embedded in the inner surface of the fitting to generate heat. The inner surface of the fitting melts first to produce a melt. The melt expands and fills the gap between the pipe and the fitting until the outer surface of the pipe also produces a melt. The two melts fuse together, and after cooling and molding, the pipe and the fitting are tightly connected into one body.

#### Description:

The general length of the pipe is 6 meters or 12 meters. Special specifications require customization and a certain amount of time for production scheduling.

Composite pipes of the same specification but different pressure ratings have different steel wire diameters and mesh parameters, but the wall thickness should not be reduced.

The nominal pressure is the maximum working pressure of the pipe when conveying a water medium at 20°C. If the medium temperature changes, a correction should be made. Please refer to the "Temperature-Pressure Reduction Coefficient Table".

#### Comprehensive Performance Comparison:

| Comparison Item                      | Steel Wire Mesh Skeleton Polyethylene Composite Pipe                                                                    | PE Water Supply Pipe                                                                          | Ductile Iron Pipe                                                                                         |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Material                             | High-density polyethylene, Steel wire mesh skeleton, High-density polyethylene                                          | High-density polyethylene HDPE                                                                | Iron                                                                                                      |
| Environmental Protection and Hygiene | Hygienic, non-toxic, non-scaling, and bacteria-free. Complies with the requirements of the national standard GB/T17219. | Good hygienic performance.                                                                    | Poor hygienic performance; long-term use will lead to corrosion and rusting, affecting water quality.     |
| Compressive and Impact Resistance    | The pressure bearing capacity of the composite pipe is close to that of a steel pipe.                                   | General pressure resistance.                                                                  | Poor impact resistance.                                                                                   |
| Hydraulic Characteristics            | Smooth inner wall, no scaling on the pipe wall, strong flow capacity.                                                   | Under the same pressure rating, the pipe wall is thicker, and the flow capacity is smaller.   | Rough pipe wall, poor flow capacity compared to plastic materials.                                        |
| Connection and Sealing               | Electrofusion connection, good sealing performance, strong connection reliability.                                      | Hot melt connection is often used, and the effect is not as good as electrofusion connection. | High requirements for construction conditions; installation quality is greatly affected by human factors. |
| Pipe Quality/Weight                  | Light pipe                                                                                                              | Heavier than steel                                                                            | Heavier pipe                                                                                              |

|                                                |                                                                                                                                 |                                                                                               |                                                                         |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
|                                                | quality/weight.                                                                                                                 | wire mesh pipe under the same pressure rating.                                                | quality/weight.                                                         |
| Construction Period and Cost                   | Light pipe weight, no need for large mechanical equipment, short construction period, and low cost.                             | Shorter construction period, low cost.                                                        | Complex construction, long construction period, high construction cost. |
| Resistance to Rapid and Slow Crack Propagation | Due to the restraining effect of the skeleton, the composite pipe has excellent resistance to rapid and slow crack propagation. | Poor resistance to rapid and slow crack propagation, posing hidden dangers for long-term use. | Strong resistance to rapid and slow crack propagation.                  |
| Service Life                                   | 50 years                                                                                                                        | 50 years                                                                                      | 10-25 years                                                             |

### Application Areas

Municipal Engineering: Urban building water supply, drinking water, fire-fighting water, natural gas transmission pipelines

Marine Engineering: Seawater desalination plants, seaside power plants, seawater transmission pipelines in port cities

Agricultural Engineering: Deep well pipes, water filter pipes, culvert transmission pipes, irrigation pipelines

Oilfield Engineering: Oily sewage, gas field sewage, secondary and tertiary oil recovery and transmission pipelines

Chemical Engineering: Acid, alkali, salt manufacturing industries, transmission pipelines for corrosive gases, liquids, and solids

Coal Mine Engineering: Water supply and drainage, compressed air, shotcrete, and gas extraction, etc.

### Product Specifications and Technical Parameters

Execution Standard: GB/T32439-2015 "Steel Wire Mesh Reinforced Polyethylene Composite Pipes for Water Supply".

### Specifications and Dimensions

| Nominal Outer Diameter (mm) | Nominal Pressure PN (MPa)<br>0.8 | 1.0 | 1.6 | 2.0 / 2.5 | 3.5 |
|-----------------------------|----------------------------------|-----|-----|-----------|-----|
|                             | Nominal Wall Thickness (mm)      |     |     |           |     |
| 50                          | -                                | -   | 5.0 | 5.5 / 6.0 | 6.5 |
| 63                          | -                                | -   | 5.5 | 6.0 / 6.5 | 7.0 |
| 75                          | -                                | -   | 6.0 | 6.5 / 7.0 | 7.5 |
| 90                          | -                                | -   | 6.5 | 7.0 / 7.5 | 8.0 |

|     |      |      |      |             |      |
|-----|------|------|------|-------------|------|
| 110 | -    | 6.0  | 7.5  | 7.0 / 8.0   | 8.5  |
| 125 | -    | 6.0  | 8.0  | 7.5 / 8.5   | 9.5  |
| 140 | -    | 6.0  | 8.0  | 8.5 / 9.5   | 10.5 |
| 160 | -    | 6.5  | 9.0  | 9.5 / 10.5  | 11.5 |
| 200 | -    | 7.0  | 9.5  | 10.5 / 12.5 | 13.0 |
| 225 | -    | 8.0  | 10.5 | 10.0 / 12.5 | -    |
| 250 | 8.0  | 10.5 | 12.0 | 12.0 / 13.0 | -    |
| 315 | 9.5  | 12.0 | 13.0 | 13.0 / 14.5 | -    |
| 355 | 10.0 | 12.5 | 14.0 | -           | -    |
| 400 | 10.5 | 13.0 | 15.0 | -           | -    |
| 450 | 11.5 | 14.0 | 16.0 | -           | -    |
| 500 | 12.5 | 16.0 | 18.0 | -           | -    |
| 560 | 17.0 | 20.0 | 21.0 | -           | -    |
| 630 | 20.0 | 22.0 | 24.0 | -           | -    |

### Performance Indicators

| Item                          | Test Conditions                                                                                                    | Indicator                                                                                                                                    |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Hydrostatic Strength          | 20°C / 2PN, 1h<br>60°C / 1.2PN, 165h<br>60°C / 1.1PN, 1000h                                                        | No Rupture, No Leakage<br>No Rupture, No Leakage<br>No Rupture, No Leakage                                                                   |
| Burst Pressure                | Continuous pressurization at 20°C until the sample bursts                                                          | ≥3PN                                                                                                                                         |
| Melt Mass-Flow Rate (MFR)     | 190°C, 5kg                                                                                                         | The change of MFR of polyethylene before and after processing does not exceed ±25%                                                           |
| Oxidation Induction Time      | 200°C                                                                                                              | ≥20min                                                                                                                                       |
| Resistance to Stress Cracking | 100mm/min                                                                                                          | No cracks, delamination, and cracking phenomena                                                                                              |
| Peel Strength                 | 100mm/min                                                                                                          | Average peel strength ≥15N/mm<br>Single sample peel strength ≥12N/mm<br>And the peel interface is ductile failure, with a flocculent surface |
| Ring Cut Hydrostatic Strength | 20°C / 1.5PN, 165h                                                                                                 | Cutting the annular groove, no rupture, no leakage                                                                                           |
| Sanitary Performance          | The sanitary performance of pipes used for drinking water transmission complies with the requirements of GB/T17219 |                                                                                                                                              |

### Selection of Pipe Pressure Rating:

Under the specified usage conditions and long-term temperature range, the pipe should ensure a service life of 50 years, and its nominal pressure should meet the requirements of the system's design working pressure.

The design internal water pressure of the pipeline (MPa) should be calculated according to the following formulas:

$$F_{wd} \geq 0.9 \text{ (MPa)}$$

$$F_{wd} = F_w + 0.5 \text{ MPa}$$

Where  $F_w$  -- Pipeline's internal water working pressure (MPa)

The nominal pressure of the steel wire mesh skeleton plastic (polyethylene) composite pipe should be corrected when conveying water above 20°C. The maximum allowable working pressure of the pipe should be calculated according to the following formula:

$$MOP = PN - ft$$

Where MOP -- Maximum allowable working pressure (MPa);

PN -- Nominal pressure (MPa);

$ft$  -- Temperature-to-pressure reduction coefficient for a 50-year service life requirement, which should comply with the provisions in the table below.

### Temperature-to-Pressure Reduction Coefficient:

| Temperature<br>$t/^\circ\text{C}$ | $0 \leq t \leq 20$ | $20 < t \leq 30$ | $30 < t \leq 40$ | $40 < t \leq 50$ | $50 < t \leq 60$ |
|-----------------------------------|--------------------|------------------|------------------|------------------|------------------|
| Correction<br>Coefficient $ft$    | 1.00               | 0.95             | 0.90             | 0.86             | 0.81             |

The nominal pressure (PN) of the pipes and fittings used in the steel wire mesh skeleton plastic (polyethylene) composite pipeline system must not be less than the design internal water pressure  $F_{wd}$  of the pipeline system, and  $F_{wd}$  should be calculated according to the provisions of the above formulas.

### Pipeline Construction

Connection method: Electrofusion connection is generally used.



The steps for electrofusion connection are as follows:



① Prepare tools



② Clean the pipe



③ Mark the length



④ Scrape off the surface



⑤ Insert the fitting



⑥ Electrify and fuse

### Precautions:

- Electrofusion connection equipment shall be provided by the party B, and operations should be carried out under the guidance of the manufacturer's technical personnel;
- The connection end face of the pipe should be sealed and perpendicular to the axis of the pipeline. Clean cotton waste should be used to wipe off the dirt on the connection surface, and the connection surface should be kept from getting damp. Operation in water is strictly prohibited;
- Before electrifying, the axis at the joint should be aligned so that it is on the same axis as the pipeline;
- Before electrifying, it should also be checked whether the wire connection is correct, whether the cross-sectional area of the wire and the power supply capacity meet the relevant requirements of the electrofusion welding machine; whether the heating voltage (or heating current) and heating time comply with the provisions of the electrofusion fitting welding parameters;
- During the fusion and cooling process, the parts of the joint and the pipelines on both sides must not be moved or rotated.

## Pipeline Installation and Laying Construction

- Construction personnel have passed the training on pipeline installation technology for steel wire mesh skeleton composite pipes and mastered the basic operational requirements.
- Pipes and fittings entering the site should be inspected at the construction site. The use of products that do not meet standard requirements is strictly prohibited.
- Technical requirements for construction surveying, dewatering, trenching, trench support and handling of pipeline crossings, and co-trench construction of buried pipelines should be implemented in accordance with the current national standard "Code for Construction and Acceptance of Water Supply and Sewerage Pipeline Works" GB50268 and the relevant provisions of the local drainage pipeline technical regulations.
- Buried pipelines must be laid on undisturbed soil foundations or foundations that have been processed and backfilled to be dense after excavation. In trench sections where the groundwater level is higher than the trench bottom, the groundwater level should be lowered to below the lowest point of the trench bottom. During the entire process of pipeline laying and backfilling, water accumulation or freezing at the trench bottom is not allowed. Measures to lower groundwater can only be stopped after the backfill soil exceeds the pipe top by 0.5m and the pipeline meets the anti-flotation requirements.
- The construction of building water supply and drainage pipelines should coordinate with the progress of civil structure construction. Good preparation should be made for reserved holes, embedded sleeves, and embedded parts for pipelines passing through walls and other structures. The size and position of the holes should meet design requirements. Before pipeline installation, the position and elevation of the reserved holes and wall-penetrating sleeves should be checked and verified.
- The length of the wall-penetrating sleeve must not be less than the wall thickness. Floor-penetrating sleeves should be 50mm higher than the floor structure surface, and ground-penetrating sleeves should be 100mm higher than the ground surface. When there are no provisions in the design, the inner diameter of the sleeve can be 50mm larger than the outer diameter of the water supply pipe. The gap between the water supply pipe and the sleeve should be filled with caulking material and sealed. When passing through outer walls, it should be combined with the construction of the outer wall waterproofing layer to meet the sealing requirements at the wall-penetrating pipe.
- When laying buried pipelines, marks on the outer walls of pipes and fittings must be located on the top surface of the pipeline; marks on riser and horizontal pipe systems in buildings must be located on a side that can be observed.
- During the laying and installation process of the pipeline system, pipelines generally must not be used as pulling points, hoisting points, brackets, etc.

## Water Pressure Test

- After the laying and installation of the pipeline engineering are completed, a pressure test of the pipeline system should be conducted. Before the pressure test, for the pipe section to be tested in the buried pipeline system, it should be checked whether the backfill soil meets the requirement

that the cover soil layer on top of the pipe is not less than 0.5m, except that the pipeline interfaces are exposed; whether the thrust blocks, supports, and anchoring facilities that must be set on the pipeline system meet the bearing capacity requirements; for the indoor pipeline system, it should be comprehensively checked whether all installation parts are in place and secure.

- The strength test and leak tightness test of buried pipelines must be carried out with a water pressure test using water as the medium.
- Water filling of the pipeline should be done slowly from a low point. During water filling, an exhaust valve should be set at the top of the pipe at the high point of the test pipe section and at the raised points in the pipe section to exhaust the gas in the pipeline. After the pipeline is filled with water, it is advisable to soak it for not less than 12h under a condition not exceeding the working pressure before conducting the test and pressure trial.
- When the pressure rises to the design pressure value, a pipeline strength test should be conducted. Under the condition of maintaining constant pressure for 1h, check whether all parts of the pipeline, all joints, accessories, etc., have permeation or other abnormal phenomena. To maintain the pressure in the pipeline, water can be added into the pipeline. If the above situations do not exist, it can be judged as qualified.
- After the strength test is qualified, pressurization should be stopped, and all exhaust and drain valves should be closed. A leak tightness test should be conducted within 2h of maintaining constant pressure. If a pressure drop occurs within the first 1h of maintaining constant pressure, water should be added to the pipeline to keep it at the specified test pressure; within the subsequent 1h of constant pressure, the pressure drop and water replenishment amount should be measured. This water replenishment amount is the actual water seepage amount of the pipeline, and its water replenishment amount must not be greater than the allowable value calculated by the following formula:

$$Q=3\times\frac{d_i}{25}\times\frac{F_t}{0.3}$$

Where Q -- Allowable water replenishment amount of the pipeline per kilometer per day (24h) (L);

$d_i$  -- Inner diameter of the pipe (mm);

$F_t$  -- Pipeline test pressure (MPa), adopting the design internal water pressure  $F_w + 0.5\text{MPa}$  specified in this manual, and it must not be less than 0.9MPa.

- When the length of the buried pipeline is greater than 500m and the pipe diameter is not less than 200mm, the leak tightness test should be judged by the method of measuring the pipeline water seepage amount.

· When the length of the buried pipeline is less than 500m and dn is less than 200mm, the water pressure test can adopt the pressure drop method. The test result of the pressure drop method should comply with the following provision: The water supply pipeline is stabilized for 2h under the test pressure  $F_t$  (MPa) and the working pressure  $F_w$  (MPa), and the pressure drop must not be greater than 0.03MPa.

· The water pressure test of indoor pipeline systems can adopt the pressure drop method. The test pressure  $F_t$  and the judgment method of pressure drop can be implemented according to the above provisions for buried pipeline systems.

· When a pipeline system composed of a steel wire mesh skeleton composite pipe and different varieties of pipes connected to it are combined for on-site water pressure testing, the test can be conducted according to the test pressure specified by the standards of the different varieties of pipes connected to it.