Runjing Irrigation Valve Product Support Manual

Bottom valve for water pump
G3001 Series

Hydraulic control valve
G2101Series

Water outlet pile valve
G1301 Series

Water outlet pile valve
G1101 Series

WENZHOU RUNXIN MANUFACTURING MACHINE CO.,LTD

Preface

Traditional irrigation methods, such as flood irrigation and canal irrigation, have low water resource utilization rates, involve heavy manual labor, and result in low production efficiency. These methods cannot provide precise irrigation tailored to the habits of plants, leading to over-irrigation or uneven watering. This, in turn, affects plant growth and results in poor crop yields and quality. China faces a shortage of water resources, especially in the main grain-producing areas, where water scarcity severely impacts the country's overall food security. To ensure stable grain production and eliminate reliance on the weather for farming, China has proposed the large-scale construction of high-standard farmland. The plan is to build about 800,000 square kilometers of high-standard farmland by 2030, including about 73333.33 square kilometers equipped with efficient water-saving irrigation systems.

Currently, in domestic irrigation systems, the valves mainly used are imported solenoid valves and diaphragm valves from the United States or Israel, copies of foreign solenoid valves and diaphragm valves, or plastic ball valves and butterfly valves. The sealing components of solenoid valves and diaphragm valves are usually made of rubber or plastic, which are less wear resistant against impurities. When opening, these valves need to overcome the spring force. Sometimes, in drip irrigation systems with low water pressure, diaphragm valves struggle to open, leading to valve malfunction. The bodies and cores of plastic ball valves are typically made of plastic, while the seats are made of PTFE, forming a soft-seal structure. These valves are not resistant to scouring and have poor wear resistance and durability. The handles of manual ball valves are prone to breaking and usually need to be replaced within a year, resulting in significant waste. In drip irrigation systems, it is common to install multiple valves on a single water outlet pile for sequential irrigation. This setup involves complicated pipeline installation and cumbersome operations. To ensure even irrigation in different zones, the valves need to be repeatedly adjusted for pressure, making the operation complex.

The tail-end system of agricultural irrigation, that is the terminal water outlet equipment, its durability, water-saving performance and advanced operability also have strategic significance. The Runjing Ceramic Hard Sealing Intelligent Irrigation Valve can meet the above requirements.

By utilizing advanced ceramic sealing technology, Runxin has developed a series of products, including Runjing bottom valves (for water pumps), hydraulic control valves, disk filters, water and fertilizer integrated machines, water outlet pile valves, and ceramic hard sealing ball valves. The opening and closing components, as well as the flow-through parts, are all made of special ceramic materials. These products are suitable for various complex irrigation water qualities and environmental conditions, requiring minimal maintenance and inspection, and can be reused for many years. They offer high cost-effectiveness and significant social and economic benefits, and can contribute to the sustainable development of modern agricultural irrigation.

This book provides a detailed introduction to the features and applications of the Runjing irrigation valve series. It was collaboratively written by relevant personnel from the

R&D Department, Intelligent Irrigation Valve Department, Marketing Department, Quality Control Department, and other departments of Runxin. Given the limited expertise of the editors, we welcome any criticism and suggestions for correcting any oversights in the book.

Editors
March, 2025

Catalog

1. Special Ceramic Hard Sealing Valve

1.1 Special ceramic hard sealing valve

The components for opening and closing, reversing, and flow rate control in the special ceramic hard sealing valves—**are all made from ultra-high hardness, corrosion-resistant special ceramic** materials. Runjing agricultural irrigation valves are divided into ceramic water outlet pile valves and ceramic ball valves. The valve cores of the ceramic water outlet pile valves and the valve cores and seats of the ceramic hard sealing ball valves are made from either alumina ceramic or silicon carbide materials. These materials are processed through ultra-high-temperature sintering at 1680°C or 2200°C and precision machining. The valves feature low torque, wear resistance, corrosion resistance, and long service life.

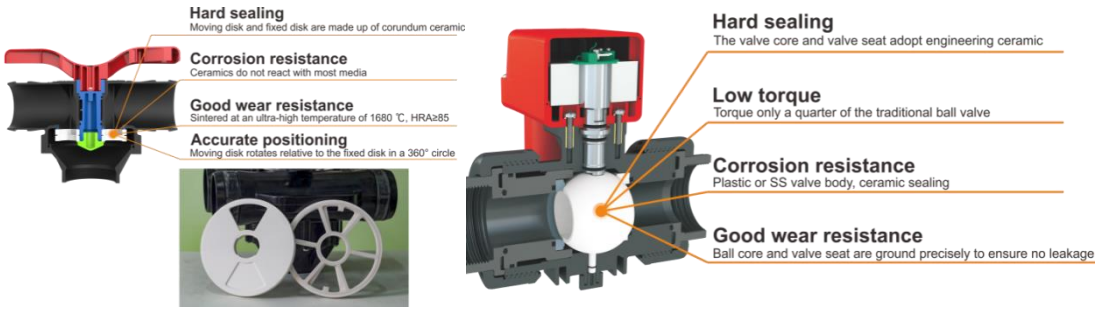


Figure 1-1 Internal structure of Runjing irrigation valve

In 2003, Runxin developed a special ceramic hermetic sealing structure control valve, known as the Runxin Valve, which broke the long-term monopoly of foreign brands. After more than 20 years of continuous development, Runxin has created a series of products with over 140 specifications, ranging from 1 to 50 m^3/h. These products are suitable for various applications such as filtering, softening, and specialty water treatment, and are available in manual, automatic, and remote control via mobile phone. The reliability of these products has been verified by users in159 countries and regions worldwide.

中国·润新阀
CHINA RUNXIN VALVE

Figure 1-2 China Runxin Valve

In 2012, Runxin made a technological breakthrough from ceramic hermetic sealing to spherical sealing, developing the Runjing ceramic hard sealing ball valve. This valve has been widely applied in industrial fields such as wastewater treatment, chemical processing, dyeing, metal smelting, lithium battery production, and fluid intelligent control. It has been exported to 36 countries and regions worldwide. In the field of irrigation, it can solve problems associated with traditional irrigation valves such as plastic ball valves and solenoid diaphragm valves, which are not durable, not resistant to impurity wear, and prone to leakage.

Figure 1-3 Runjing ceramic hermetic sealing ball valve

In 2024, Runxin developed a series of products, including **bottom valves (for water pumps), hydraulic control valves, and water outlet pile valves (3-way/5-way)**, using advanced ceramic sealing technology. These products cover the entire irrigation system, including the headworks, control components, water distribution control, and end water outlet valves. **The components for opening and closing, reversing, and flow regulation are all made from high-hardness special ceramic materials.** These materials offer high hardness, resistance to impurities, wear resistance, corrosion resistance to fertilizers, and a long service life. The products require minimal maintenance and inspection and can be used in various complex irrigation water qualities and environmental conditions.

Figure 1-4 Runjing irrigation valve

1.2 Performance of Special Ceramic

High hardness: The special ceramic materials (alumina Al_2O_3 and silicon carbide Sic) have extremely high hardness, with a HRA of more than 85. As can be seen from the hardness comparison chart of common materials on the right, their hardness is second only to diamond and sapphire. They are 7 to 9 times the hardness of steel and comparable to that of tungsten carbide cutting tools, demonstrating excellent wear resistance.

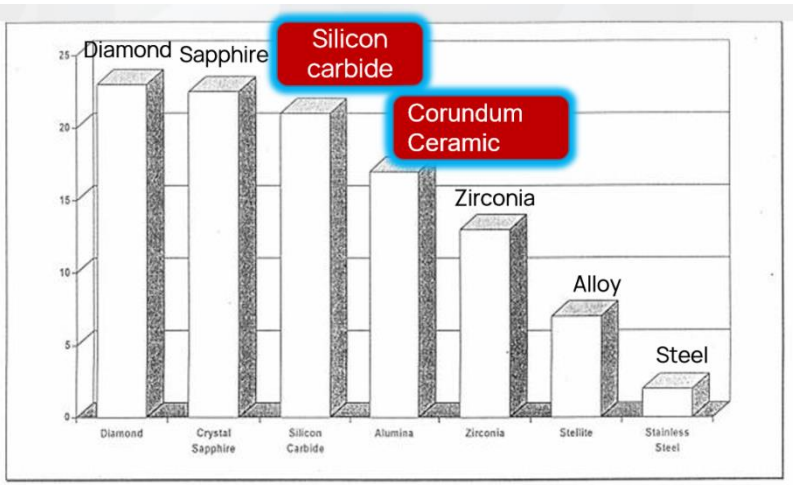


Figure 1-5 The hardness comparison chart of common materials

Durable: The Runjing ceramic hard sealing ball valve has excellent durability. The Runjing DN32 stainless steel ball valve has been tested by the National Valve Quality Supervision and Inspection Center (Zhejiang). Under a pressure of 0.6 MPa, with an opening time of 1 second and a closing time of 3 seconds, the valve showed no leakage after 1 million cycles of opening and closing, and continued to maintain no leakage for 1 minute.

Figure 1-6 The test report of Runjing DN32 stainless steel ball valve

Good corrosion resistance: Special ceramic materials excel in chemical stability, maintaining stability in highly corrosive media such as strong acids and alkalis, and demonstrating excellent corrosion resistance, as detailed in Table 1-1. In irrigation systems, the nutrient solution contains soluble solid particles and has a certain concentration of acids and alkalis. This requires that the associated valves be wear-resistant and corrosion-resistant. Special ceramic hard sealing valves can withstand the corrosion of nutrient solutions, thereby extending the service life of irrigation equipment and ensuring continuous production.

Table 1-1 Comparison of corrosion resistance of common valve materials

Media	Temperature	ZrO_2	$95Al_2O_3$	Sic	Si_3N_4	SS304	SS316
20%HCL	60℃	A	A	A	B	C	C
	95℃	A	A	A	C	—	—
90%H_2SO_4	60℃	A	A	A	A	C	C
90%H_2SO_4	95℃	A	A	A	B	C	C
60%H_3PO_4	60℃	A	A	A	C	C	C
	95℃	A	A	A	C	C	C
10%HF	60℃	C	B	A	A	C	C
46%HF	95℃	C	C	A	C	—	—
60%HNO_3	60℃	A	B	A	C	A	A
	95℃	A	C	A	C	B	B
30%NaOH	60℃	A	C	A	B	A	A
	95℃	B	C	A	C	A	B

A. Indicates that the material is non-corrosive or negligible in the medium, and is recommended for use;

B. Indicates that the material is slightly or minimally corroded in the medium and is suitable for use;

C. Indicates that the material has moderate or significant corrosion in the medium and is not recommended for use.

2. Products for irrigation systems

2.1 Irrigation systems

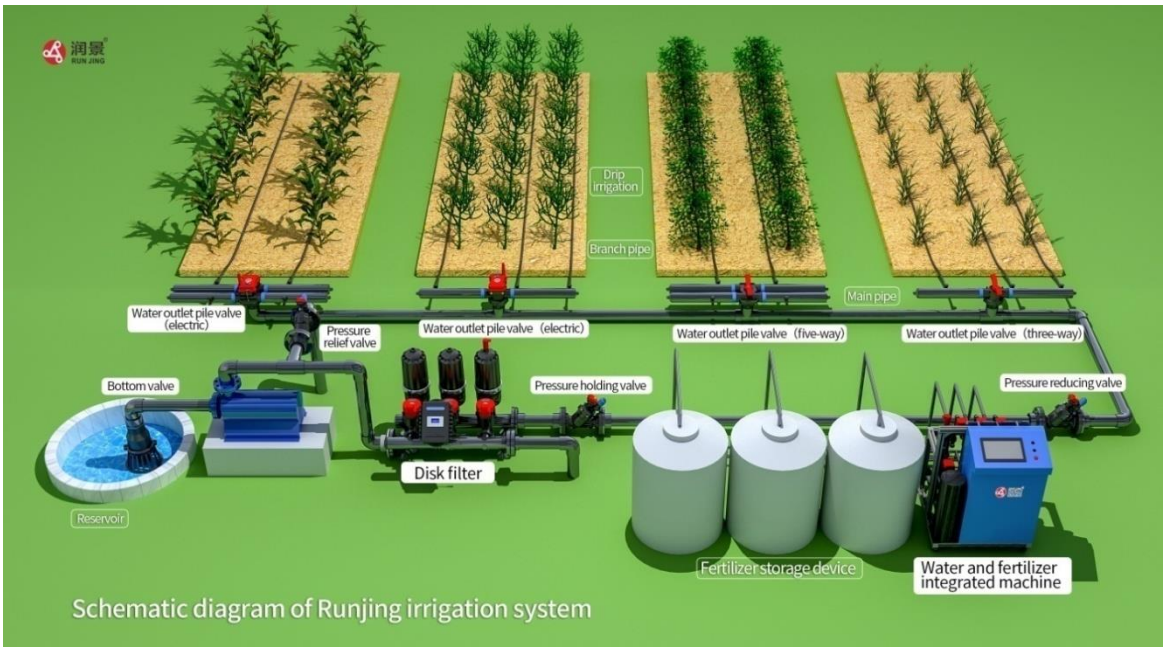


Figure 2-1 Schematic diagram of irrigation system

The irrigation system mainly consists of a water source (reservoir), water pump, bottom valve, pressure relief valve, disk filter, pressure holding valve, fertilizer storage device, water and fertilizer integrated machine, pressure reducing valve, water outlet pile valve, pipelines (main pipe, branch pipe, drip pipe), sprinkler, and control system.

Water Source: Common water sources include wells, rivers, and lakes. When the water source has a high sand content or large impurities, it usually needs to be treated by sedimentation to ensure the water quality meets irrigation requirements.

Water Pump: Draws water from the source and provides the water conveyance power for the entire system.

Bottom Valve: Installed at the water pump's suction inlet, it prevents water from flowing back to the source or pool when the pump stops.

Pressure Relief Valve: Installed at the outlet of the main pipeline, it quickly relieves pressure when the pipeline pressure is too high, ensuring system safety.

Disk Filter: Installed at the outlet of the main pipeline, it filters out silt and other particulate impurities in the water to prevent sprinkler blockage.

Pressure Holding Valve: Installed after the disk filter at the outlet of the main pipeline, it ensures the front-end pressure so that the disk filter has enough water pressure for backwashing.

Water and Fertilizer Integrated Machine: Dissolves fertilizer in the water and injects it into the main pipeline, achieving integrated water and fertilizer irrigation.

Pressure Reducing Valve: Installed on the irrigation branch line, it stabilizes the irrigation water pressure.

Water Outlet Pile Valve: Used to achieve rotational irrigation in various irrigation zones, it generally has pressure stabilizing or regulating functions, controlling the opening and closing of irrigation water and regulating irrigation pressure.

Main Pipe: Transports water treated by the headworks to various branch pipes.

Branch Pipe: Further distributes water from the main pipe to various drip pipes.

Drip Pipe: Connects to the drip emitter, directly conveying water to the crop roots.

Control System: Including irrigation controller, pressure gauge, flow meter, etc., it monitors and controls the system's operating status to ensure stable system operation.

2.2 Bottom valveG3001 series

In agricultural irrigation systems, the bottom valve is an important component to ensure the normal start and operation of the water pump. It is generally installed at the bottom end of the water pump suction pipe, mainly used to prevent the water in the suction pipe from flowing back to the water source or pool when the pump stops working. This keeps the water pump suction pipe always full of water, making it convenient for the pump to start quickly and work normally the next time. At the same time, the bottom valve also has a certain filtering effect, which can prevent large particle impurities or flocculants in the water from entering the water pump and affecting its normal operation.

Traditional bottom valves generally use metal valve disks and metal valve seats for sealing. Metal is prone to rust, leading to poor sealing. After the pump stops, the water in the pipeline will slowly leak. When starting again, water needs to be added to the pipeline to start, which is troublesome and can easily cause the pump to run empty.

Runxin company has developed the Runjing special ceramic hard sealing bottom valve (patent application No.: 20242282530X). It uses high-hardness, high-flatness ceramic valve disks and ceramic valve seats to achieve sealing. The design combines a lift-type ceramic valve disks with a conical plastic guide, with no spring mechanism. The

weight is reduced by 60%, and the water head loss is reduced by 15%. It only needs to overcome the gravity of the ceramic valve disk to open, and can be opened with a 10cm water column.

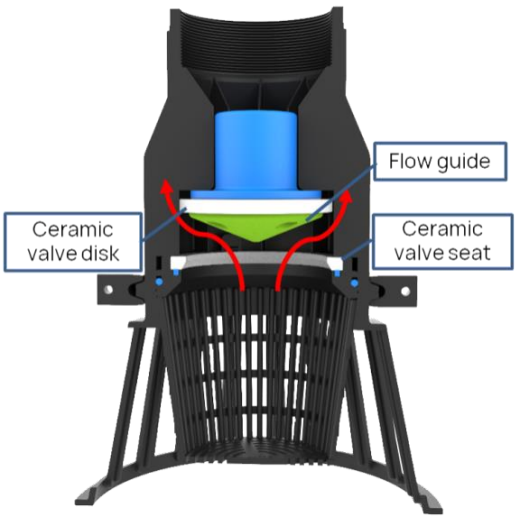


Figure 2-2 Cross section of Runjing ceramic hard sealing bottom valve

Table 2-1 Comparison of Runjing bottom valve with similar products on the market

Product comparison	**Ceramic hard sealing bottom valve**	**Cast iron/Stainless steel bottom valve**	**Stainless steel bottom valve**	**PVDF PVDF bottom valve**
Picture				
Sealing parts	Corundum ceramic hard sealing	Cast iron/Cast steel/Stainless steel Rubber soft seal	304/316 Stainless steel hard seal	PVDF PVDF plastic rubber soft seal
Abrasion resistance	Excellent	Poor	Average	Poor
Lifespan	Long	Short	Long	Short
Head loss	Low	High	High	Medium

The Runjing ceramic hard sealing bottom valve (for water pump) uses a patented energy-absorbing buffer rubber sealing ring design, which is impact-resistant and has a service life of over 100,000 times. The high-flatness ceramic valve disk and ceramic valve

seat are tightly sealed, improving the static pressure holding efficiency by 30%, reducing the pump start-up time, and is suitable for river water, lake water, well water, and other occasions. The Runjing bottom valve (for water pump) is made of corrosion-resistant engineering plastic and ceramic composite materials, suitable for irrigation water sources containing chemical salts (such as saline soil) or organic acids (such as biogas liquid). It is currently available in 3-inch and 4-inch specifications.

Figure 2-3 Runjing 3-inch bottom valve

Figure 2-4 Runjing 4-inch bottom valve

Table 2-2 Runjing bottom valve model and specification table

Model	G3001-80	G3001-100
Diameter	DN80	DN100

2.3 Hydraulic control valve G2101/G2201/G2301/G2401 series

In agricultural irrigation systems, hydraulic control valves play a crucial role in regulating and controlling water pressure and flow to ensure the efficient and stable operation of the system.

Traditional hydraulic control valves consist of a main valve, pilot valve, and electromagnetic directional valve, using rubber soft sealing. They are not wear-resistant to impurities, prone to leakage, and aging. The electromagnetic directional valve is also prone to clogging and failure. In actual complex water quality irrigation conditions, they are prone to faults, affecting the stability of the irrigation system operation. Additionally, the connection pipes between the pilot valve and the directional valve are messy, requiring high professional skills from assembly workers, which is not conducive to large-scale batch production.

Figure 2-5 Traditional hydraulic control valve (pressure reducing valve)

Figure 2-6 Traditional hydraulic control valve (pressure holding valve)

Runxin company, based on special ceramic hard sealing technology, has developed Runjing ceramic hard sealing hydraulic control valve (patent application no.: 202411761252.3; 202422969314.4). It consists of a main valve, pilot valve, and directional valve. The valve core moving and stationary pieces of the main valve and directional valve are made of special ceramic materials, which are wear-resistant to impurities and not prone to clogging. The pilot valve and directional valve are integrally connected, making pipeline connection convenient. It uses the difference in piston area to achieve opening and closing, and can be opened and closed with low water pressure. Equipped with an electric actuator, it can achieve wireless remote control.

Since the Runjing ceramic hard sealing hydraulic control valve has the characteristics of wear resistance to sand and corrosion resistance, it has a low failure rate and higher comprehensive cost-effectiveness.

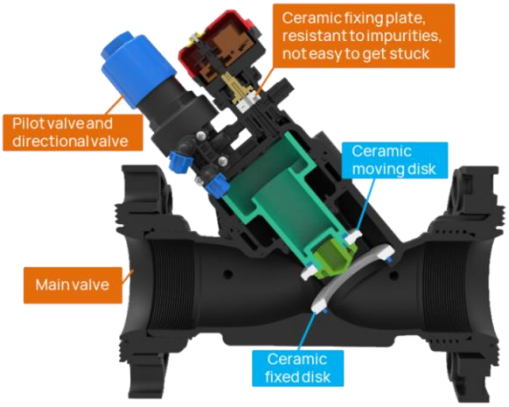


Figure 2-7 Cross-section of Runjing hydraulic control valve

Runjing hydraulic control valve can be selected for different functions such as pressure reducing, pressure holding, pressure relief, and on-off control. Only the pilot valve assembly structure and the connecting hose with the main valve need to be replaced to achieve these functions. Moreover, the pressure reducing, pressure holding, and pressure relief functions can all be manually controlled or equipped with an electric actuator to achieve remote control via mobile phone APP or computer.

2-3 Comparison of Runjing hydraulic control valve with similar products on the market

Product comparison	Runjing hydraulic control valve	DRT hydraulic control valve	BRMT hydraulic control valve
Picture			
Sealing material	Special ceramic	Rubber/Plastic	Rubber/Plastic
Directional valve	Ceramic electric valve	Electromagnetic valve	Electromagnetic valve
Abrasion Resistance	Excellent	Poor	Poor
Service Life	Long (3-5 times that of traditional valves)	Need to replace seals regularly	Need to replace seals regularly
Pipeline connection	Simple	Complex	Complex
Maintenance cost	Low	Medium	Medium

The model and specifications are shown in Table 2-4. **The DN150 caliber hydraulic control valve is currently under development and will soon be launched on the market**.

Pressure reducing function: The valve is installed at the front end of the water-using equipment and can stabilize the water pressure of the rear water-using equipment and irrigation pipeline. When the upstream water pressure is too high or changes, the Runjing pressure reducing valve can automatically adjust the valve opening to keep the outlet pressure within the set range, avoiding damage to the rear water-using equipment due to overpressure.

Figure 2-8 Manual pressure reducing valve

Figure 2-9 Electric pressure reducing valve

Pressure holding function: The valve is installed at the rear end of the water-using equipment and can ensure the pressure stability of the front water-using equipment. When the pressure at the front end of the valve is less than the set value due to increased water usage at the rear end, the valve automatically reduces the opening to ensure that the pressure at the front end of the valve is not less than the set value, thereby ensuring the pressure of the water-using equipment, such as having enough water pressure for the backwash of the disk filter.

Figure 2-10 Manual pressure holding valve

Figure 2-11 Electric pressure holding valve

Pressure relieving function: The valve is installed on the main pipeline. When the pipeline pressure rises significantly, the valve automatically opens to discharge the excessive pressure, avoiding pipeline bursts and protecting the pipeline safety.

Figure 2-12 Manual pressure relief valve

Figure 2-13 Electric pressure relief valve

On-Off function: The valve is installed in the irrigation main or branch pipeline and is used for on-off control of the irrigation waterway.

Figure 2-14 Manual On-Off valve

Figure 2-15 Electric On-Off valve

Table 2-4 Runjing hydraulic control valve model and specification table

Function	Caliber	Pressure reducing valve	Pressure holding valve	Pressure relief valve	On-Off valve
Electric control	DN65	G2101D-65	G2201D-65	G2301D-65	G2401D-65
	DN80	G2101D-80	G2201D-80	G2301D-80	G2401D-80
	DN100	G2101D-100	G2201D-100	G2301D-100	G2401D-100
Manual control	DN65	G2101S-65	G2201S-65	G2301S-65	G2401S-65
	DN80	G2101S-80	G2201S-80	G2301S-80	G2401S-80
	DN100	G2101S-100	G2201S-100	G2301S-100	G2401S-100
LORA control	DN65	G2101L-65	G2201S-65	G2301L-65	G2401L-65
	DN80	G2101L-80	G2201L-80	G2301L-80	G2401L-80
	DN100	G2101L-100	G2201L-100	G2301L-100	G2401L-100

2.4 Disk filter RJ-DF2/F3 series

The water used for agricultural irrigation is usually surface water or groundwater such as river water and lake water, which contains impurities such as sediment and flocculation.

At present, the common laminate filter in the market generally uses three-way diaphragm valve to reverse, and the three-way diaphragm valve uses a rubber seal, which is a soft seal structure, not resistant to impurities and easy to leak. The valve chamber is equipped with a spring to pre-tighten, which cannot be opened when the water pressure is low.

Runxin company based on the ceramic hermetic head faces sealing and disk filter technology, Runjing has developed a high flow disk filter composed of disk filter unit ceramic hard sealing hermetic head faces three-way valve and controller. The ceramic hard sealing three-way valve (Patent No.: ZL202223080527.9) is used to control the direction change, and the valve core is a special ceramic sealing sheet with high hardness and flatness, which is a hard sealing structure, reliable sealing, sediment resistance, wear resistance, and long service life. Ceramic moving disk type rotating switching channel to prevent impurities from entering the sealing surface, with a single system processing capacity of 20-700m ³/h and an IP67 protection level suitable for harsh outdoor environments; Support intelligent linkage of 16 filtering units, triggering automatic backwash through time/pressure difference, and increasing water saving rate by 25%.

Table 2-5 Comparison of Runjing disk filter with similar products

Product comparison	Runjing disk filter	Israel NTFM filter	Xiamen HZ disk filter
Picture			
Structural Principle	Disk automatic backwashing	Disk filter	Disk automatic backwashing
Control Valve	Ceramic sealing three-way valve Wear-resistant	Electric diaphragm valve Not resistant to wear and tear	Rubber/plastic Not wear-resistant
Switching Pressure	Can switch without pressure	Requires certain pressure	Requires certain pressure
Abrasion Resistance	Excellent	Poor	Poor
Service Life	Long 3-5 times that of traditional valves	Short Need to replace parts regularly	Short Need to replace parts regularly
Applicable Medium	High impurity fluid	Clear water, low impurity fluid	Clear water, low impurity fluid
Maintenance Cost	Low	Medium	High

Filter element of Runjing disk filter is made up of high-strength, good wear resistant plastic sheets, and is engraved with 480 micron-sized filter troughs on one side, which is hardly to be counted clearly by the naked eye, nearly 300 pieces of the same disk are tightly pressed together, and the grooves between the disk intersect to form a filter unit. Currently, there are 50 microns, 100 microns or 130 microns three filtration accuracy for optional. It can automatically start backwash by time or pressure drop, and can be equipped with 1 to 16 sets of filter units, the maximum treatment flow can reach about 700 m^3/h, except for agricultural irrigation water filtration, it can also be used for plant groundwater filtration, HVAC system water filtration and sewage treatment, municipal water supply filtration and other occasions.

Working principle of Runjing disk filter：**During filtering**, the raw water enters the inlet pipe, passes through the ceramic core electric three-way valve and enters the filtering unit. Under the action of the spring force and the hydraulic force, the disk groups are pressed

tightly together, and the particulate impurities are trapped at the intersection of the disk groups, the filtered water flows out from the outlet of the filter unit. **During the backwashing**, the filtered water from other filter units enters the electric three-way valve, and the electric three-way valve instantly changes the flow channel from external pressure to internal pressure, the disk group of the filtering unit is uniformly and automatically released, rotated and scrubbed, and the retained particles and impurities are quickly through the three-way valve and discharged from the drain outlet.

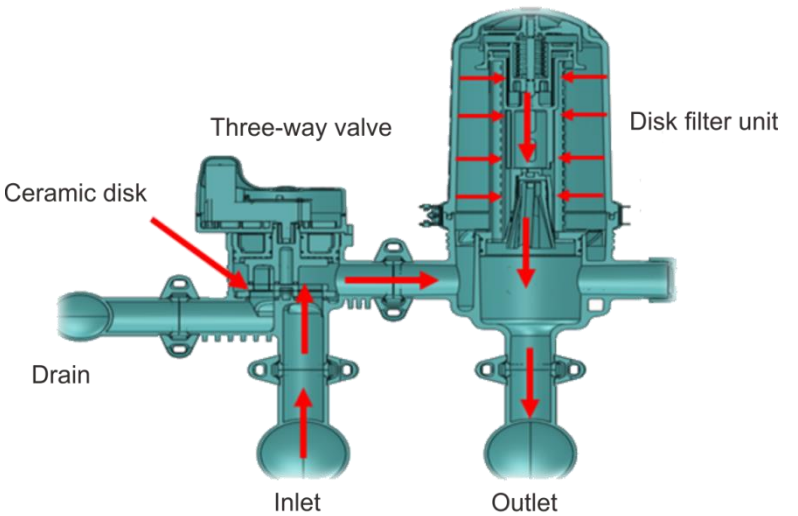


Figure 2-17 Runjing disk filter filtration state

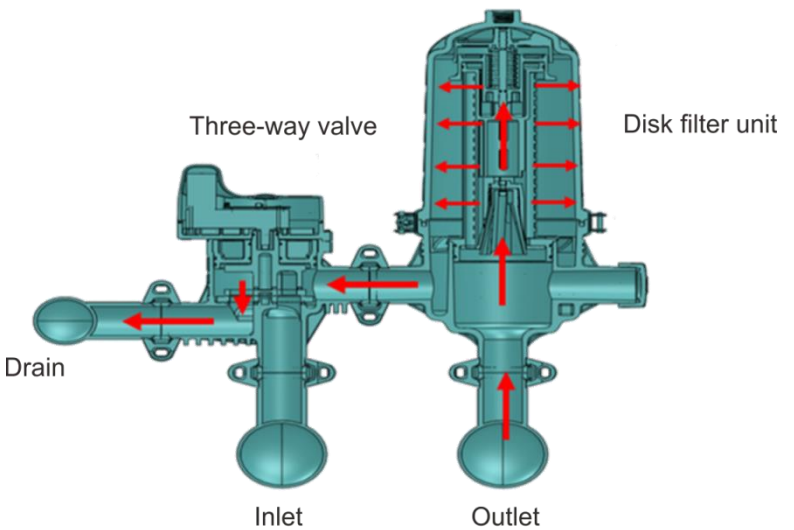


Figure 2-18 Runjing disk filter backwashing state

Table 2-6 Model and specification table of disk filter

Model	Type	Number of filters	Inlet/ Outlet	Drain	Filtration accuracy 130μm Red disk flow rate (m³/h)			Filtration accuracy 100μm Yellow disk flow rate (m³/h)			Filtration accuracy 50μm Blue disk flow rate (m³/h)		
					Excellent water quality	General water quality	Poor water quality	Excellent water quality	General water quality	Poor water quality	Excellent water quality	General water quality	Poor water quality
RJ-DF203	Single head disk	2"×3	DN100	DN80	55	37	19	40	25	10	31	19	7
RJ-DF204		2"×4			77	53	29	57	37	17	45	29	13
RJ-DF205		2"×5			99	69	39	74	49	24	59	39	19
RJ-DF303	Double head disk	3"×3	DN150	DN100	110	74	38	80	50	20	62	38	14
RJ-DF304		3"×4			154	106	58	114	74	34	90	58	26
RJ-DF305		3"×5			/	138	78	148	98	48	118	78	38
RJ-DF305		3"×5	DN200	DN100	198	/	/	/	/	/	/	/	/
RJ-DF306		3"×6			242	170	98	182	122	62	146	98	50
RJ-DF307		3"×7			286	202	118	216	146	76	174	118	62

A. Excellent water quality: urban tap water; Purified water extracted from a stable aquifer with turbidity<3 degrees.
B. General water quality: circulating cooling water, surface water treated with effective sedimentation, general well water, drainage treated with effective sedimentation and complete biological treatment, generally suspended solids<30mg/L.
C. Poor water quality: groundwater extracted from aquifers with poor water quality, which has undergone effective sedimentation but has not undergone or has undergone minimal biological treatment; Good surface water generally has suspended solids<75mg/L.
D. Very poor water quality: poor well water, surface water; non-precipitated and non-biodegraded drainage, It cannot be used as the inlet water source for laminated filters, and pre-treatment should be carried out to improve the water quality level.

2.5 Water and fertilizer integrated machine RJ-SF301

Water and fertilizer integration is a technology that dissolves soluble fertilizer in irrigation water and supplies water and nutrient to crops in regular quantity and proportion by valve control pipe system.

Water-soluble solid fertilizer and liquid fertilizer are usually used for irrigation fertilization. The fertilizer is corrosive to a certain extent. On the market common water and fertilizer one machine control valve is generally used solenoid valve or plastic ball valve, a soft sealing structure, not resistant to impurity wear, not resistant to fertilizer corrosion.

Runjing water and fertilizer integrated machine RJ-SF301 developed by Runxin, adopts ceramic hard sealing ball valve to control (Patent No.: ZL202222814101.5). Ceramic hard sealing ball valve has the characteristics of low torque, good corrosion resistance, good wear resistance, durability, etc., water and fertilizer solution corrosion resistance, long service life, and this is the biggest difference of current market water and fertilizer integrated machine.

Figure 2-19 Water and fertilizer integrated machine

Runjing water and fertilizer integrated machine RJ-SF301, which can monitor the irrigation and fertilization parameters remotely through mobile phone APP or computer, and carry out regular and quantitative irrigation and fertilization, and can automatically add up to three different fertilizers at the same time, each hour can be injected into the main pipeline fertilizer liquid 2 tons, can achieve on-site control, remote control and up to 32-way control ball valve rotation watering, with PH, conductivity value detection and fertilizer bucket level automatic control functions, watering and fertilization management is convenient and quick.

It should be Remarked that when the water and fertilizer integrated machine installed in a low-temperature frozen environment, the water in the pipeline and valve must bed rained during the standby to avoid freezing and cracking the pipes and equipment.

Figure 2-20 Intelligent fertilizer machine

Figure 2-21 Water and fertilizer integrated machine

2.6 Water outlet pile valve (three-way/five-way) G1101/G1201/G1301 series

In the northwest regions of China, such as Gansu and Xinjiang, cotton, corn, and other crops are commonly irrigated using drip irrigation methods to conserve water. The irrigation systems typically involve a single outlet post with multiple valves for rotational irrigation, which makes the installation of the pipelines troublesome and the operation cumbersome. Traditional irrigation valves mainly use soft-sealing structures like diaphragm valves and plastic ball valves. The sealing components are made of rubber or plastic, which are not resistant to impurities and prone to leakage. Many plastic ball valves need to be replaced within a year of use, leading to significant waste.

Figure 2-22: One water outlet pile connected to two diaphragm valves

Figure 2-23: One water outlet pile connected to four ball valves

Runxin has developed high cost-performance water outlet pile three-way valves (G1301 series) and five-way valves (G1101/G1201 series) using special ceramic hermetic head faces sealing technology (patent application No.: ZL202411137556.5). The opening and closing flow components are made of special ceramic materials with high planarity and high hardness, which are **low torque, wear resistant, and corrosion resistant**. The valve core can rotate to quickly switch the flow paths, and the sealing surfaces automatically clean themselves. They are resistant to wear from sand and impurities, as well as corrosion from water and fertilizer solutions, reusable for many years, **pioneering one valve multi control mode**, three-way valve replaces 2 traditional valves, and five-way valve replaces 4 traditional valves, saving 60% of installation space.

Runjing water outlet pile valve (three-way and five-way) supports manual and electric dual drive, combined with 4G Internet of Things and LORA wireless control, to achieve "one-button irrigation scheduling" in large-scale irrigation areas; Combination proportional pressure reducing and stabilizing valve stabilizes irrigation water pressure, accurately controls irrigation flow, and improves crop irrigation uniformity.

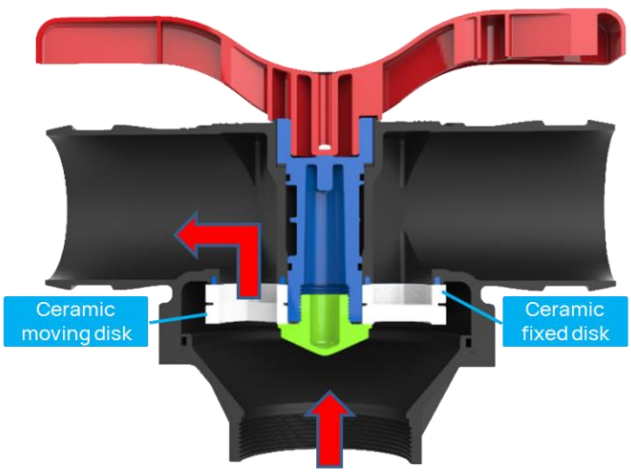


Figure 2-24 Sectional view of Runjing water outlet pile valve

Table 2-7 Comparison between Runjing water outlet pile valve and similar products

Compare brands	Runjing water outlet pile valve	Shenzhen JF irrigation valve	Shenzhen QT butterfly valve	Israel NTFM diaphragm valve
Picture				
Sealing material	Special ceramic hard sealing	UPVC soft sealing	Rubber/Plastic	Rubber/Plastic

Compare brands	Runjing water outlet pile valve	Shenzhen JF irrigation valve	Shenzhen QT butterfly valve	Israel NTFM diaphragm valve
Tightness	Excellent Resistant to impurities	Not resistant to impurities Easy to leak	Not resistant to impurities Easy to leak	Not resistant to impurities Easy to leak
Automatic Pressure Stabilizing Device	Configurable Low cost	No	No	Comes with Low cost
Service Life	More than 5 years	1-2 years	Within 2 years	Within 2 years
Opening and Closing Force	Low torque Low requirement for water pressure	Heavy torque The actuator is prone to damage	Heavy torque The actuator is prone to damage	Requires a certain amount of water pressure

Runjing water outlet pile valve (three-way or five-way) features a multi-port design with an integrated soft hose connector, offering a compact structure and convenient installation and operation. The water pressure can be adjusted by controlling the opening size, and they come in various specifications and models, including single outlet, dual outlet, and manual, 4G, or LORA remote control options.

The manual version comes with an adjustable scale, allowing for easy manual adjustment of the opening size; the electric version features automatic water pressure stabilization, eliminating the need for manual pressure adjustment. It is easy to operate and can be remotely controlled from a mobile phone or computer through 4G or LORA wireless connection. The built-in battery can last for at least one irrigation cycle, so there is no need to worry about power outages, and a solar charging function can also be optionally added.

Figure 2-25 Manual three-way valve

Figure 2-26 Electric control three-way valve

The three-way valve is designed with one inlet and two outlets, and a single outlet for

rotational irrigation. It has a shut-off function, making it convenient to operate, with a high irrigation flow rate that can reach 75m³/h at a pressure of 0.1MPa. It can be used with 3inch or 4inch outlets, with the outlet being a De90 pipe.

Figure 2-27 Manual control five-way valve

Figure 2-28 Electric control five-way valve

The five-way valve is designed with one inlet and four outlets, offering the option of single outlet watering or simultaneous dual outlet watering. It also has a shut-off function, is easy to install, and can achieve a flow rate of 67m³/h at a pressure of 0.1MPa. It can be used with 3inch or 4inch outlets, with outlet pipes available in De75 or De90 sizes. The dual-port water discharge model can achieve a flow rate of up to 120m³/h at a pressure differential of 0.1MPa, allowing simultaneous irrigation of two fields and improving irrigation efficiency.

The model specifications of three-way valves and five-way valves are shown in Tables 2-8 and 2-9. The water outlet pile valve with a 4inch inlet and drip irrigation pipe in De110 size is currently under development and will gradually be introduced to the market in the future.

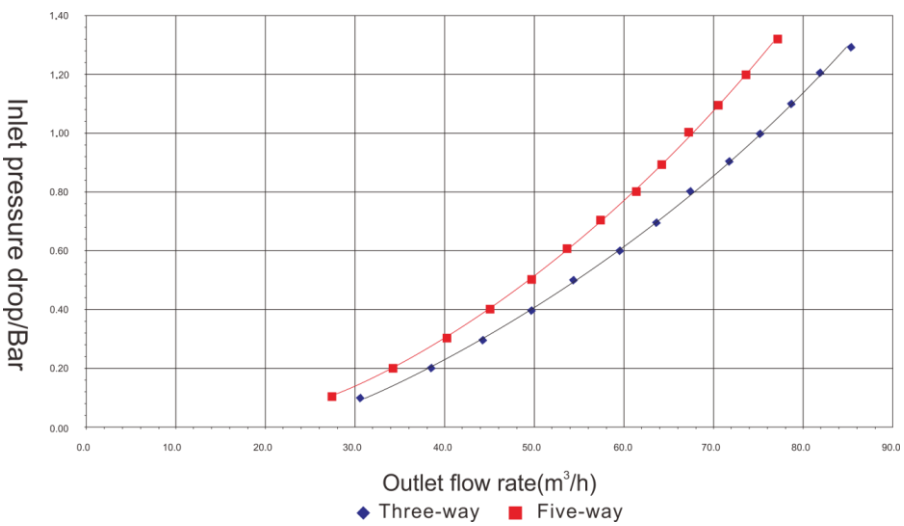


Figure 2-29 Flow curve of water outlet pile three-way valve G1301 and water outlet pile five-way valve G1101

Table 2-8 Model and specification table of water outlet pile valve (three-way)

Model	Inlet	Outlet	Control mode	Number of adjustable paths	Flow rate at 0.1MPa	Maximum working pressure	Nominal pressure
G1301S-80/90	3 inch	De90 drip irrigation pipe DN80 diameter	Manual	One- way	75m³/h	0.2MPa	0.6MPa
G1301D-80/90			Electric				
G1301L-80/90			LORA				
G1301S-100/90	4 inch	De90 drip irrigation pipe DN80 diameter	Manual				
G1301D-100/90			Electric				
G1301L-100/90			LORA				

Table 2-9 Model and specification table of water outlet pile valve (five-way)

Model	Inlet	Outlet	Control mode	Number of adjustable paths	Flow rate at 0.1MPa	Maximum working pressure	Nominal pressure
G1201S-80/90	3 inch	De90 drip irrigation pipe DN80 diameter	Manual	Two-way	120m³/h	0.2MPa	0.6MPa
G1101D-80/90			Electric	One-way	67m³/h		
G1201D-80/90				Two-way	120m³/h		
G1101L-80/90		De90 drip irrigation pipe DN80 diameter	LORA	One-way	67m³/h		
G1201L-80/90				Two- way	120m³/h		
G1201S-80/75		De75 drip irrigation pipe DN65 diameter	Manual	Two- way	120m³/h		
G1101D-80/75			Electric	One- way	67m³/h		
G1201D-80/75				Two- way	120m³/h		
G1101L-80/75			LORA	One-way	67m³/h		
G1201L-80/75				Two- way	120m³/h		

Model	Inlet	Outlet	Control mode	Number of adjustable paths	Flow rate at 0.1MPa	Maximum working pressure	Nominal pressure
G1201S-100/90	4 inch	De90 drip irrigation pipe DN80 diameter	Manual	Two- way	120m³/h	0.2MPa	0.6MPa
G1101D-100/90			Electric	One- way	67m³/h		
G1201D-100/90				Two- way	120m³/h		
G1101L-100/90			LORA	One-way	67m³/h		
G1201L-100/90				Two- way	120m³/h		

2.7 Ball valves for irrigation system

Currently, the valves for irrigation systems in the market mainly use solenoid diaphragm valves, plastic ball valves, etc. Many solenoid diaphragm valves still rely on imports, the opening and closing flow parts of the solenoid diaphragm valves are sealed with rubber and plastic, which is soft sealing structure. The rubber or plastic ages easily are not resistant to impurities, easy to leak, and not durable. The plastic valve core of the plastic ball valve is not resistant to impurities and wear and is easy to leak and jam, and big torque. The valve stem and handle are prone to breakage due to excessive torque. **The structure of traditional valve for irrigation systems has inherent defects resulting in many intelligent irrigation systems becoming "ornamental", difficult to widely spread the application.**

Runxin company applies ceramic hard sealing ball valve to the field of intelligent irrigation. Its overflow parts are made of special ceramic materials. Compared with solenoid diaphragm valve, it has the features of high hardness, low torque, good sealing, resistance to impurities, sediment wearing, fertilizer corrosion, long service life. It can effectively overcome the disadvantages of solenoid diaphragm valves and plastic ball valves.

Table 2-10 Comparison of commonly used irrigation valves

Item	Ceramic hard sealing ball valve	Plastic ball valve	Solenoid diaphragm valve
Picture			
Sealing part	Special ceramic	Plastic	Rubber/Plastic
Sealing structure	Hard sealing	Soft sealing	Soft sealing
Sealing Performance	Good sealing performance Resistant to impurities	Not resistant to impurities Easy to leak	Not resistant to impurities Easy to leak
Flow path	Straight flow path Low water resistance	Straight flow path Low water resistance	Corner flow path High water resistance
Service life	Long service life Resistant to wear	Short service life Easy to leak	Short service life Rubber easy to age
Torque	Low torque No requirement for water pressure	High torque Handle easy to break	High requirement for water pressure
Specification	Maximum DN200	Maximum DN200	Maximum DN100

2.8 Intelligent irrigation controller

Runxin company has developed an efficient automated water-saving irrigation system based on ceramic hard sealing ball valves, combined with sensor technology, wireless communication technology, and intelligent control technology. It can monitor parameters such as environmental temperature, humidity, and soil moisture in real-time in gardens or agricultural production. It also allows remote control of irrigation via phone / computers and can be integrated with digital technology for visualized and centralized management in a control room. Runxin company has developed a range of products suitable for

irrigation, including the Runjing intelligent irrigation controller, pulse ball valve, residential timing intelligent irrigation valve, and residential 4G IoT intelligent irrigation valve, it can be equipped with IoT 4G controllers and wireless networking with LORA to achieve long-distance communication. Combined with methods such as sprinkler irrigation, micro-sprinkling, and drip irrigation, it can be widely applied in various scenarios like farmlands, orchards, greenhouses, flower gardens, community greening, and courtyard greening, thereby transforming the traditional labor-intensive and inefficient manual irrigation methods.

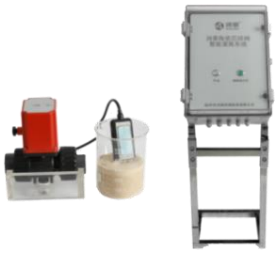
Runjing intelligent irrigation controller currently has 5 models, its model specifications are shown in Table 2-11.

Table 2-11 Model Specifications of Runjing Intelligent Irrigation Controller

Model	**Irrigation methods**	**Diameters**	**Flow rate (Under 0.1MPa)**
RJ-ZG01	Time irrigation, 5 groups of time-point can be set for irrigation each day	DN20-DN50	6-30m³/h
RJ-ZG02	Single way for irrigation, with pressure and electricity for irrigation	DN20-DN200	6-140m³/h
RJ-ZG03	2-8 ways for irrigation, no pressure source and with municipal electricity for irrigation	DN20-DN200	6-140m³/h
RJ-ZG04	Solar for switching, with pressure source and no municipal electricity for irrigation	DN20-DN200	6-140m³/h
RJ-ZG05	Solar for switching, no pressure and no electricity for irrigation	DN20-DN200	6-140m³/h

Table 2-12 Features of Rujing Intelligent Irrigation Controller

Model	**Picture**	**Features**
RJ-ZG01		Adopts Runjing timing ball valve, DN15-DN50 ball valves with two-wire controlling are optional, different ball valve diameters can be selected according to the size of the pipeline, and 5 groups of time-point can be set for irrigation each day. Suitable for automatic irrigation with tap water and pressurized water source.

Model	Picture	Features
RJ-ZG02		Consists of a controller, ceramic hard sealing ball valve, sensor, etc. It is used for single way irrigation, suitable for the occasions with municipal electricity, tap water or pressurized water source.
RJ-ZG03		Consists of a controller, pump, Runjing ball valve, sensor, etc. It is used for 2-8 ways irrigation. Suitable for irrigation with municipal electricity, micro or non-pressure water source. Equipped with a water pump, it can be suitable for irrigation from rivers, well, lake and other water sources.
RJ-ZG04		Consists of a solar panel, battery, controller, Runjing ball valve, sensor, etc. Suitable for the occasions without municipal electricity with pressurized water source. The solar panel charges the battery for the controller and the valve. Equipped with 60 watts of solar panels, a DC12V Runjing electronic ball valve can work continuously for 60 hours.
RJ-ZG05		Consists of a solar panel, battery, controller, pump, Runjing ball valve, sensor, etc. Suitable for the occasions without municipal electricity and pressurized water source. It can effectively solve the remote areas without electricity or lack of electricity farmland, orchard, garden from groundwater, rivers, lakes, and ponds water irrigation problems. Equipped with 50-1000 watts of solar panels, a DC24V Runjing electronic ball valve under the condition of power generation with an average daily sunshine duration of 6 hours can continue to irrigate for 4-6 hours.

2.9 Pulse ball valve Q941512S series

Irrigation valves are generally installed at a certain distance from the controller, and the controller often needs to control multiple valves. If wired connections are used, it is necessary to dig trenches and tie wires, which results in high construction costs. In addition, some terrains are difficult to construct. To solve this problem, Runxin has developed a pulse ball valve (Patent No.: ZL202222814101.5), its model specifications are shown in Table 2-13.

Figure 2-30 Pulse ball valve

Table 2-13 Model specifications of Runjing pulse ball valves

Model	Connection	Flow channel	Body	Core	Control Type	Diameter
Q911512S-15/50	PPO female thread	Straight	UPVC	Alumina/ Silicon Carbide	Electric control (DC12V)	DN15-DN50
Q931512S-15/80	UPVC glue					DN15-DN80
Q951512S-15/25	PPR hot melting					DN15-DN25
Q941512S-65/80	UPVC flange					DN65-DN80
Q911412S-15/80	316L female thread		316L			DN15-DN80
Q941412S-20/80	316L flange					DN20-DN80
Q981412S-20/50	316L clamp					DN20-DN50
Q934512S-20/25	UPVC glue	L-type 3-way	UPVC	Alumina	Electric control (DC12V)	DN20-DN25
Q954512S-20/25	PPR hot melting					
Q914512S-25/50	PPO female thread		PPO			DN25-DN50
Q934512S-25/50	UPVC glued					
Q934512S-65/80	UPVC glue		UPVC			DN65-DN80

When the Runjing pulse ball valve receives a forward pulse signal, the ball valve

opens, and when it receives a reverse pulse signal, the ball valve closes. Low power consumption, standby current ≤10μA, battery powered, can run for 1-3 years without charging, can be powered by solar panel and lithium battery. By combining IoT 4G controllers and LORA wireless networking, long-distance wireless communication can be achieved, and remote monitoring can be achieved through PC or mobile APP. The sequential opening and closing of each group of valves can be achieved through self-programming. Adopting a special ceramic hard sealing structure, it is resistant to wear from sediment impurities, and corrosion from fertilizer solutions.

Generally, DN20-DN100 specifications use plastic valve body, driven by motors. For DN100 and above specifications use metal valve body, driven by a pilot hydraulic system. The direction is switched by an electric pilot valve, which uses the pressure of liquid or air to push the ball valve actuator to open and close the ball valve. The operating power consumption is low.

2.10 Residential intelligent irrigation valve RJ-ZG06 / RJ-ZG07

For some home-users who enjoy planting flowers, using a kettle to carry water or pulling a hose to water is time-consuming and laborious. When family members are all away on business or travelling, watering the flowers and plants on the balcony and courtyard becomes a challenge. Automatic watering devices on the market generally use solenoid valve for controlling, which has problems such as coil burnout, not resistant to impurities, and easy to leak.

For this purpose, Runjing has developed a cost-effective residential intelligent irrigation valve. The control valve's component for passing liquid through adopts a special ceramic hermetic head face sealing structure. It has a rotary opening and closing mode with the sealing surface being automatically cleaned. It features light torque, good resistance to impurities and excellent sealing performance. There are two types of timing control and 4G IoT mobile phone remote control.

Residential intelligent irrigation valve RJ-ZG06 (Patent No.: ZL202320911911.4) is a patented product of Runxin company. It is powered by dry batteries with 1-2 years lifetime, easy to install. It can be set by the precise watering time and watering duration to achieve automatic timed watering. It has rain sensor function which can stop watering automatically in raining day. The water inlet is equipped with anti-clogging filter screen to filter out particles and impurities in the water. Its size is only about the size of an adult's

palm. Under 0.1MPa differential pressure, the flow rate can reach 2m³/h, which can meet the irrigation needs of 200 square meters. When paired with various sprinkler heads, it can achieve even irrigation and can easily conduct automatic irrigation. It is suitable for irrigation occasions such as potted plants of various sizes, flowerpots on balconies, courtyard gardens and vegetable plots. It is convenient, practical and inexpensive.

RJ-ZG 07 is a residential 4G IoT intelligent irrigation valve. In addition to the functions of ZG06, it also adds 4G remote control function. People in other places can also monitor the watering situation at any time through a mobile app at any time, any place, with just one click watering, which is very convenient. It can be equipped with humidity sensors and 3-in-1 sensor, setting parameters such as flow rate, humidity, temperature, and conductivity to achieve intelligent and precise irrigation.

Figure 2-31 Residential timing intelligent irrigation valve RJ-ZG06

Figure 2-32 Residential 4G IoT intelligent irrigation valve RJ-ZG07

2.11 Integrated valve combined with metering and controlling RJ-ZG12L / RJ-ZG13L

In northwest regions such as Xinjiang in China, drip irrigation technology is used on many occasions where crops like cotton and grapes are cultivated. Sometimes an irrigation area can reach several million or even tens of millions of square meters. Usually, when the system is designed, a pool is built at a high place as the irrigation water source, and drip irrigation is carried out by utilizing the natural water pressure generated by the height difference. To prevent the high pressure caused by a large height difference from breaking the drip irrigation pipes, it is necessary to ensure pressure stability in each irrigation branch. Generally, the water pressure is kept stable by adjusting the opening degrees of different valves.

Runjing RJ-ZG12L 3-way integrated valve combined with metering and controlling for

drip irrigation (Patent No.: ZL202320969180.9), can achieve the functions of water flowing in from the bottom and out from the left or flowing in from the bottom and out from the right. Single valve can control two channels for irrigation, which is equivalent to two valves, and can greatly save costs. The opening degree of the ball valve can be adjusted through pressure or flow sensors. It adopts photovoltaic power supply, has low power consumption, and can be configured with LORA wireless communication. It adopts a special ceramic sealing structure, which is resistant to sediment and impurities, and has a longer service life.

China lacks water resources, and irrigation water requires payment and metering. Currently, butterfly valves or diaphragm valves combined with flow meters are mainly used in the market. Since the diaphragm valve has an angular flow channel and the flow meter needs to meet the requirement of having straight pipe sections with a length of ten times the diameter before it and five times the diameter after it to ensure accuracy, so the two products are placed relatively far apart from each other. However, the control parts of the two products need to be interoperable in terms of information with each other, which leads to inconvenient control. Runxin company adopted the full diameter characteristics of Runjing ceramic hard sealing ball valve, installs the flow meter in the valve, and developed straight-way integrated valve RJ-ZG13L which is combined with metering and controlling (Patent No.: ZL202320969180.9). It is combined with metering and controlling to save the pipeline space, which is easy to control. It has various control methods such as wiring, 4G, LORA. The valve core is a special ceramic material, which is resistant to wear and impurities, and is durable.

Figure 2-33 Integrated valve combined with metering and controlling RJ-ZG13L

Figure 2-34 Integrated valve combined with metering and controlling RJ-ZG12L

2.12 Intelligent irrigation house

In the process of agricultural production, the working environment of farmers is relatively poor, and they work in the fields for a long time, exposed to wind, sun, and rain. With the development of the economy and society, in recent years, most farmers engaged in frontline agricultural production are over sixty years old, and there are fewer and fewer young people willing to become farmers. Future agricultural production must change the impression of traditional agriculture in order to attract more young people to engage in agricultural production.

Based on this idea, Runxin company proposed to build intelligent irrigation houses in irrigated areas.

Install equipment such as the Runjing intelligent irrigation valve, high flow disk filter, water and fertilizer integrated machine, etc. inside the house, with a TV as a monitoring screen, electric fans, water purification equipment, washing equipment, etc. can also be installed. The roof of the house is covered with solar panels for use by the indoor TV, fan, monitoring equipment, etc. Remote centralized visual management can be achieved via mobile phones or computers. Its model specifications are shown in Table 3-5.

Figure 2-35 Runjing intelligent irrigation house

Table 3-5 Model Specification of Intelligent Irrigation House

Model	Length × Width × Height (m)	Supporting Equipment
RJ-XW01	4×3×3.2	3 sets of disk filter, water and fertilizer integrated machine, etc.
RJ-XW02	5×3×3.2	6 sets of disk filter, water and fertilizer integrated machine, etc.
RJ-XW03	6×3×3.2	9 sets of disk filter, water and fertilizer integrated machine, etc.

Note: Equipped with different diameters of irrigation ball valves, suitable for irrigation applications ranging from 10 to 1000 acres.

3.Runjing intelligent irrigation valve field test

Under the technical guidance of Gong Shihong, Director of the Agricultural Water Saving Equipment Branch of the China Association for Agricultural Water Conservation and Rural Water Supply Technology, and Former Deputy Director of the Water Resources Research Institute of the China Academy of Water Resources and Hydropower Sciences, Runxin company has cooperated with Beijing Zhongshui Runke Certification Co., Ltd. and the National Agricultural Irrigation and Drainage Equipment Quality Inspection and Testing Center, to carry out the "Durability Testing Project of Runjing Ceramic Hard Sealing Ball Valve Intelligent Irrigation Series Products in Actual Working Conditions" in the Donglei Yellow River Irrigation Project in Shaanxi Province, the Irrigation Test Station of Turpan Water Science Institute in Xinjiang, the Qing'an Irrigation Test Station in Heilongjiang Province, and the Seventh Level Pumping Station of Yanggu County Drainage and Irrigation Center in Weishan Irrigation District, Liaocheng City, Shandong Province. The testing of Runjing ceramic hard sealing ball valve and intelligent irrigation valve series products in high turbidity water of Yellow River Project have been carried out the applicability in extremely complex environments such as extremely hot and cold regions, the test results indicate that:

A. After optimizing the sealing ring flow channel of the ceramic hard sealing ball valve, **the sedimentation of sediment in the flow channel is effectively reduced, and the torque is stable.**
B. Under high temperature, high sandstorm, and high cold environments, there is no significant change in the torque of ceramic hard sealing ball valve, proving that **ceramic hard sealing ball valve can still maintain stable performance under these extreme environmental conditions.**
C. The sealing of ceramic hard sealing ball valve performs well under high sediment, high temperature, high wind and sand, and high cold conditions, without leakage, proving that **ceramic hard sealing ball valve can still effectively prevent leakage under these harsh conditions.**
D. The external dimensions and core of the ball valve show no significant changes under high sediment, high temperature, high sandstorm, and high cold conditions, proving that **the structure and materials of ceramic hard sealing ball valve has stability and durability under extreme environmental conditions.**

3.1 Test 1: Shaanxi Donglei Yellow River Irrigation Project (sediment content 9kg/m³), Shandong Liaocheng Weishan Irrigation District Yanggu County Drainage and Irrigation Center (sediment content 13kg/m³)

The Donglei Yellow River Irrigation Project in Weinan, Shaanxi Province is located in Heyang County, Weinan City. It is a national large-scale (II) irrigation area, with the Yellow River as its water source and a high sediment content of 9kg/m³. This testing conducted field tests on wear resistance, weather resistance, service life, torque, and other performances of aluminum oxide and silicon carbide ball valves with DN20-DN200 diameters and plastic and stainless-steel valve body, DN50 Runjing ceramic hard sealing integrated valve combined with metering and controlling.

Figure 3-1 Test 1: Shaanxi Donglei Yellow River Irrigation Project (high turbidity water of Yellow River Project)

Weishan Irrigation District is in Liaocheng City, Shandong Province, and is the largest Yellow River irrigation district in the lower reaches of the Yellow River. The performance and application effect testing project of Runjing ceramic hard sealing ball valve is carried out at the seventh stage pump station of Yanggu County Drainage and Irrigation Center in Lishan Irrigation District, using Yellow River water for testing **with a sediment content of 13kg/m³**. This testing conducted field tests on sediment resistance, wear resistance, durability, and other performances of Runjing ceramic hard sealing ball valves with DN20-DN150 diameters.

Figure 3-2 Test 1: Yanggu County Irrigation and Drainage Center in Weishan Irrigation District, Liaocheng City, Shandong Province (sediment content 13kg/m³)

3.2 Test 2: Irrigation Test Station of Turpan Water Science Institute in Xinjiang (extremely hot area, surface temperature of 80℃)

Turpan City is in the central part of Xinjiang Uygur Autonomous Region, with a hot and extremely dry climate and frequent strong winds, in some places, the surface temperature reached 80℃. This testing conducted field tests on wear resistance, torque, service life, weather resistance, and other performances of pulse electronic and hydraulic ball valves, silicon carbide ball valves with DN20-DN150 diameters, and DN50 Runjing ceramic hard sealing integrated valve combined with metering and controlling.

Figure 3-3 Test 2: Irrigation Test Station of Turpan Water Science Institute in Xinjiang (Extremely hot area, surface temperature of 80℃)

3.3 Test 3: Qing'an National Irrigation Test Station in Suihua City, Heilongjiang Province (extremely cold area, extreme temperature of -40℃)

The Qing'an Irrigation Experimental Station is in Heping Irrigation District, Qing'an County, Suihua City, Heilongjiang Province. It has a high latitude, obvious seasonal

changes, and large differences in climate throughout the four seasons, the extreme temperature is below -40℃. It is a national key irrigation experimental station, covering an area of more than 180,000m^2, including more than 113,000 m^2 of paddy fields. This test conducted field tests on low temperature resistance, wear resistance, torque, service life, and other performances of alumina and silicon carbide ball valves with DN20-DN150 diameters and pulse electronic controlled, and DN50 Runjing ceramic hard sealing integrated valve combined with metering and controlling.

Figure 3-4 Test 3: Qing'an National Irrigation Test Station in Suihua City, Heilongjiang Province (Extremely cold area, extreme temperature of -40℃)

4.Runjing intelligent irrigation valve application cases

Runjing intelligent irrigation valve has been used for agricultural irrigation in Xinjiang, Inner Mongolia, Hebei, Hubei, Zhejiang and other places, and it is putted into used for irrigation in municipal landscaping, villa gardens, golf courses and other places. It saves water and electricity and has intelligent control, thus is well received.

4.1 Application of Runjing intelligent irrigation valve in agricultural irrigation

Tiansai Winery with 1,300,000 m^2 vineyard in Korla, Xinjiang, originally used artificial watering, which had problems such as high labor intensity and easy damage to plastic valves. Among them, 33,000 m^2 vineyard improves and installs Runjing intelligent irrigation valves, equipped with multiple DN65 Runjing pulse electronic ball valves controlled by solar energy for switching, which are resistant to particle impurities and wear, durable for use. Through LORA wireless network, no need for digging and wiring, with low installation and maintenance costs. Also, it can realize remote control by phone APP. It is equipped with miniature weather station, allowing for an intuitive understanding of

meteorological data such as light intensity, temperature and humidity, making irrigation management more efficient and scientific.

Figure 4-1 Application of intelligent irrigation valve in Xinjiang KorlaTiansai Winery

The Chunhu Eco-Agriculture Park in Yongchun county, Quanzhou, Fujian province covers an area of more than 200,000 m^2. The terrain is a typical hilly slope, the low elevation is about 30 meters above sea level, the high elevation is about 380 meters above sea level, more than 2000 citrus trees are planted as well as the construction of Runjing intelligent irrigation house, which has been installed equipment like water and fertilizer integrated machine irrigation system with Runjing ceramic hard sealing ball valves and high flow disk filter and large screen monitor, watering and fertilization can be controlled remotely from cell phones and computers, allowing for visual irrigation and fertilization management in the house, by using Runjing ceramic hard sealing electronic pulse ball valve to realize LORA zonal watering and fertilization, Runjing ceramic hard sealing disk filter can filter out sediment, suspended solids and other impurities in the water, improve irrigation water quality.

Figure 4-2 Application of intelligent irrigation valve in the
Chunhu Eco-Agriculture Park in Yongchun county, Quanzhou

The Ou citrus produced in Wenzhou Sanyang Wetland are very popular. In the Ou citrus orchard that is over 100,000 m2 Runjing intelligent irrigation house is built, together with the installation of Runjing water and fertilizer integrated machine with intelligent irrigation system, and high flow disk filter system, through LORA applying zonal watering and fertilization management, using cell phones and computers to remotely control irrigation, fertilization, the visual irrigation and fertilization management are also achievable in the intelligent irrigation house with the equipment of several Runjing large caliber ceramic hard sealing ball valve. The use of Runjing intelligent irrigation house greatly changes the traditional agriculture inherent impression, and provides assistance for the development of modern agriculture, helping the harvest of Ou citrus. According to the keeper of Wenzhou Sanyang Wetland Ou citrus orchard's reflection, in 2024, there are more than 20,000 Ou citrus trees in the orchard, after using Runjing water and fertilizer integrated machine irrigation machine, through phone operation, 6,000m^2 to 13,000 m^2 of land can be irrigated at one time, in addition, the Ou citrus are also larger, with more than 200g.

Figure 4-3 Application of intelligent irrigation valve in 100000 m^2 Ou citrus orchard in Sanyang Wetland, Wenzhou

Wenzhou Qidu Future Urban Agriculture Park is a leisure agriculture park that integrates culture, tourism and recreation, parent-child study and rural tourism. Runjing intelligent irrigation house is built in a park with 100,000 m^2 of cauliflower and corn planting areas, equipped with Runjing water and fertilizer integrated machine with intelligent irrigation system, disk filter system, it is available to remotely control by cell phones and computers and proceed centralized visual management. It is equipped with multiple solar-controlled large-diameter Runjing ceramic hard sealing electronic pulse ball valves, zonal watering and fertilization can also be carried out through LORA.

Figure 4-4 Application of intelligent irrigation valve in Wenzhou Qidu Future Urban Agricultural Park

Hubei Jiangling Sanhu Yellow Peach Modern Agriculture Demonstration Orchard has an area of 66,000 m^2, including 6,000 m^2 of yellow peach cultivation greenhouses improved and install Runjing water and fertilizer integrated machine with intelligent irrigation system equipped with multiple solar-controlled Runjing ceramic hard sealing ball valves, it can achieve precise watering and fertilizer by remote control by phone or PC, which helps to increase the yield of yellow peaches.

Figure 4-5 Application of intelligent irrigation valve in Hubei Jiangling SanhuHuangtao Modern Agriculture Demonstration Park

Wenzhou Agricultural Science Research Institute, which has 666,000 m^2 farm in Tengqiao. Including 26,000 m^2 for vegetable planting, using RJ-ZG02 Runjing intelligent irrigation valve, equipped with multiple Runjing pulse electronic ball valves controlled by solar energy. Through LoT 4G controller and LORA wireless network, to achieve irrigation remote controlled by phone and PC. Also, it can be controlled in groups for precise drip irrigation of vegetables such as cabbage and broccoli.

Figure 4-6 Application of intelligent irrigation valve in
Wenzhou Agricultural Science Research Institute

Fengzeyuan Agriculture Company in Jingzhou, Hubei has more than 13,000 m^2 of greenhouses were Runjing intelligent irrigation system with ceramic hard sealing ball valve equipped with multiple Runjing ceramic hard sealing pulse electronic ball valves, which can set timing irrigation and remotely control through phone or PC, lower the intensity of manual labor, helps improve the quality and yield of vegetables and fruits.

Figure 4-7 Application of intelligent irrigation valve in
Fengzeyuan Ecological Agriculture Park, Jingzhou City, Hubei Province

4.2 Application of Runjing intelligent irrigation valve in irrigation of landscape greening

The green belt in the courtyard of Lucheng District was originally irrigated by labors, which has high labor costs, uneven watering, and wasting water. Runjing intelligent irrigation valves cover a 1,400 m^2 green area in the courtyard, which can set timing irrigation and remotely control through phone or PC, greatly reducing labor costs and saving water resources.

Figure 4-8 Application of intelligent irrigation valve in Lucheng District, Wenzhou City

RJ-ZG03 Runjing intelligent irrigation valve has been installed in the green area of over 500 m^2 in Ma'anchi Park, Wenzhou City. It can be remotely controlled through phone to meet the water-saving irrigation needs of different types of flowers and plants. Installing RJ-ZG05 type Runjing solar control intelligent irrigation valve in the 1000 m^2 green area of the small island, with an average daily power generation of 6 hours of sunshine and sustainable irrigation of 4-6 hours, solving the problem of electricity shortage on the island and significantly reducing the cost of green maintenance.

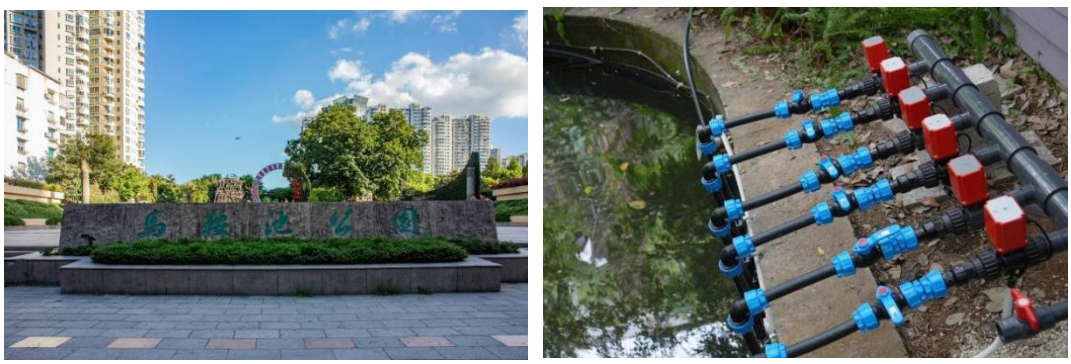


Figure 4-9 Application of intelligent irrigation valve in Ma'anchi Park, Wenzhou City

The Country Garden Tianhui Residential Area in Qiaoxi District, Shijiazhuang covers an area of over 30,000 m^2, more than 5,000 m^2 of greenery in the community has been installed the RJ-ZG02 Runjing intelligent irrigation valve, equipped with multiple solar controlled Runjing ceramic hard sealing pulse electronic ball valves. It can be set for timed watering and automatically watered according to soil moisture conditions. Watering can be remotely controlled through phone or PC, reducing labor and maintenance costs.

Figure 4-10 Application of intelligent irrigation valve in Shijiazhuang Tianhui Country Garden

Lishui Two Lakes Park is a large park in the center of Lishui City, integrating recreation, entertainment and sightseeing. Runjing intelligent irrigation house is built in a park with 4500 m^2 of greenbelt, equipped with Runjing intelligent irrigation valve and disk filter. It is also equipped with multiple Runjing pulse electronic ball valves with ceramic hard sealing and can be zoning irrigated through LORA wireless networking. It can automatically irrigate according to soil moisture conditions and can be remotely controlled through phone or PC, tremendously reduce labor intensity, improve irrigation efficiency and save maintenance costs. Runjing intelligent irrigation house protects the intelligent irrigation equipment from sun and rain, prolongs the service life of the equipment.

Figure 4-11 Application of intelligent irrigation valve in Lishui Two Lakes Park

4.3 Application of Runjing intelligent irrigation valve in villa greening irrigation

The greening maintenance of a villa garden in Yongjia, Wenzhou is equipped with the RJ-ZG03 Runjing intelligent irrigation valve, together with 8 Runjing ceramic hard sealing ball valves. It can be remotely controlled through phone for irrigation. Combined with drip irrigation, micro irrigation, sprinkler irrigation and other technologies, it can meet the

irrigation needs of different green plants such as lawns, potted plants, shrubs, etc., greatly reducing maintenance costs, saving irrigation water.

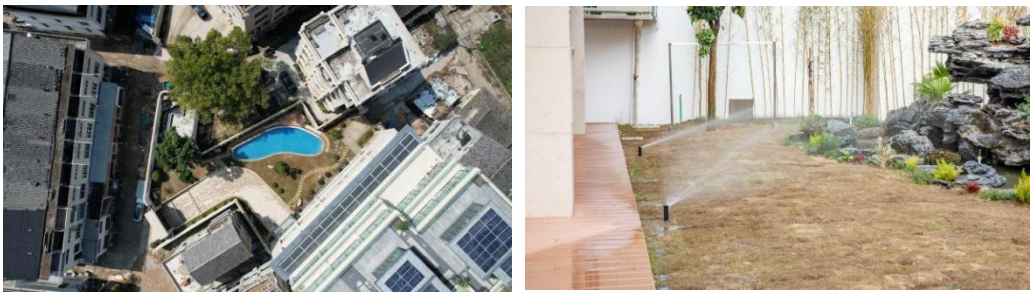


Figure 4-12 Application of intelligent irrigation valve in a Villa Garden in Yongjia, Wenzhou

4.4 Application of Runjing intelligent irrigation valve in golf course irrigation

Wenzhou Dongfang Golf Course is located in the western suburb of Wenzhou City Forest Park, covers an area of more than 333,000 m^2, the course is installed the RJ-ZG04 Runjing intelligent irrigation valves, equipped with multiple Runjing pulse electronic ball valves, It can be remotely controlled by phone for watering, timely supplementing the soil moisture of the stadium, and improving the quality of the lawn.

The course originally used piston and diaphragm valve as the pressure relief device for irrigation system, which exists problems such as inaccurate control, diaphragm rubber parts aging, piston jamming, regulator components clogging valve failure leading to burst pipe and so on. Now it has transformed into Runjing DN100 electronic regulator ball valve with ceramic hard sealing for pressure relief, the operation is now stable, pressure relief is precisely controlled.

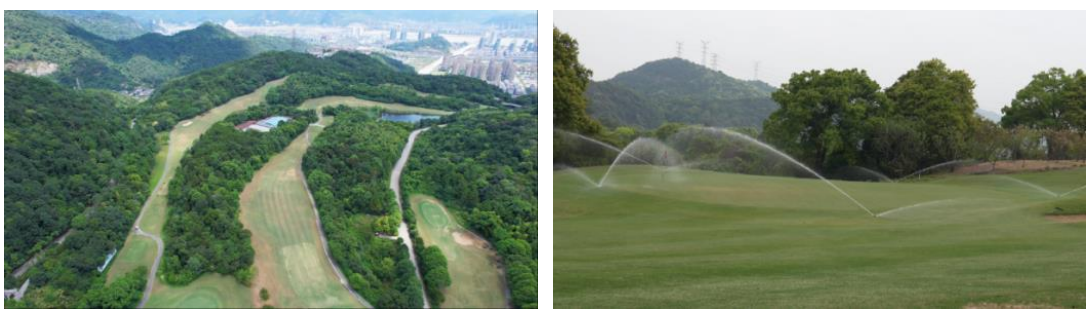


Figure 4-13 Application of intelligent irrigation valve in Wenzhou Dongfang Golf Course

5.Company profile

Wenzhou Runxin company was founded in 2000. The headquarters is located in Shanfu Town, Lucheng District, Wenzhou City, covering an area of 42,666 square meters and a construction area of nearly 120,000 square meters. And Zhejiang Runlucky Purification Technology Co., Ltd., a wholly owned company which manufactures residential (commercial) water treatment equipment is established in Lishui Economic Development Zone, covering an area of 44,333 square meters and a construction area of nearly 83,000 square meters. Hankcraft Runxin LLC is joint venture company. It locates in Wisconsin, USA and provides residential and commercial water treatment products to North American customers. A ceramic parts production base is established in Fenghua District, Niingbo City, covering an area of 11,333 square meters and a construction area of nearly 20,000 square meters. It produces 5,000,000 sets of ceramic disks and ceramic balls annually.


Figure 5-1 Factory in Shanfu Town


Figure 5-2 Factory in Lishui (Wholly-owned company:
Zhejiang Runlucky Purification Technology Co., Ltd.)

Figure 5-3 Hankcraf Runxin LLC

Figure 5-4 Ningbo ceramic parts production base

Runxin company focuses on researching, developing, and manufacturing multi-functional flow control valve for water treatment systems, Runlucky residential (commercial) water treatment equipment, Runjing ceramic hard sealing ball valve and ball valve for intelligent irrigation system (Runjing intelligent irrigation valve), which are energy-saving, healthy, and environmentally products. It has been recognized as a National New High-tech Enterprise, National Specialized, Fined, Peculiar and Innovative “Little Giant” Enterprise, National Green Factory, National Intellectual Property Advantage Enterprise, Zhejiang “Hidden Champion” Enterprise, Zhejiang Patent Model Enterprise, Wenzhou “The Most Beautiful Factories”, and has been selected as Zhejiang Digital Workshop and awarded as Zhejiang Export Famous Brand, Wenzhou Quality Management Innovation Award, Irrigation Strengthening Agriculture Excellence Brand and other honorary titles. Provincial Enterprise Technology Center, Zhejiang Water Supply Treatment System Research Institute, Provincial High-tech Enterprise Research and Development Center are established. Participate in GB/T 18300 "Automatic control of sodium ion exchange machine technical conditions", GB/T 13922 "Water treatment equipment performance test" and other national standards and industry standards formulation and revision. The inspection center of Runxin company has obtained the national CNAS laboratory certification.

Figure 5-5 Partial enterprise honor

Runxin company has passed ISO9001 Quality Management System, Occupational Health and Safety Management System, Environmental Management System and Energy Management System certification, in 2005 began to apply for PCT international patents and obtained the invention patent authorization from the United States, Russia, South Korea, Mexico, India and EU member states Germany, France, Spain and other 17 countries. As for February 2025, Runxin has obtained more than 140 patents, including 20 invention patents and 91 utility model patents.

Since August 2010, “Runxin valve” has continuously passed the United States NSF certification every year. Runlucky residential softener has passed the NSF certification of the United States in 2020. Runxin valve and Runlucky complete system have also passed the EU CE, RoHS certification and French ACS certification, Russian EAC certification and UK UKCA certification.

Figure 5-6 Partial invention patents

Figure 5-7 Partial international certification

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ADD.: NO.169, RUNXIN ROAD,SHANFU TOWN, WENZHOU, ZHEJIANG, CHINA

Tel: +86-577-88630038 +86-577-88576512 E-mail: sales@run-xin.com

Fax:+86-577-88633258 Http://www.run-xin.com P.C.:325021

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