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ARCHITECTURAL FOUNTAINS: COMPONENTS AND DESIGN

TECHNICAL GUIDE TO UNDERSTANDING AN ARCHITECTURAL FOUNTAIN AS AN INTEGRATED SYSTEM

FOUNTAIN TECHNOLOGY

FOUNTAIN SOLUTIONS

FOUNTAIN EQUIPMENT

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APPROACH AND SCOPE OF THE GUIDE

The architectural fountain as an integrated system

An **architectural fountain** should not be understood as a sum of independent parts, but as an **integrated technical system**. The visible result, including jets, lighting, movement, water stability and ease of operation, depends on hydraulics, treatment, electrical systems, lighting and control working in a coordinated way from the design stage.

This approach is especially important in urban architectural fountains, public spaces, hotels, squares, parks, shopping centers and architectural projects where the system must operate reliably, adapt to its surroundings and remain in suitable condition for years.

Not every installation requires the same technology level: a static composition can be solved with simple logic, while dancing, dry deck or interactive fountains need more advanced control layers. The key is to correctly define the type of installation and, from there, size each component with an overall system view.

Purpose of the guide

The purpose of this guide is to explain, from a technical and commercial perspective, how an architectural fountain is organized, what function each subsystem performs and what criteria should be considered to design reliable, maintainable and visually coherent installations.

- **Support decision-making** in urban, public, hospitality, commercial and architectural projects.
- **Organize the components** by functional categories in order to understand their relationship within the system.
- **Reduce design errors** caused by analyzing fountain heads, pumps, lighting or control in isolation.
- **Support commercial communication** with clients, specifiers, architects and engineering firms.

This guide is aimed at professionals who need to understand the **architectural fountain** as a **coordinated set of hydraulics, treatment, electrical systems, lighting and automation** and maintenance.

GENERAL TECHNICAL DESCRIPTION

An architectural fountain as a system, not as a catalogue of parts

The technical value of an architectural water fountain does not lie only in the chosen fountain head or in the height of the water jets.

A fountain head only works correctly if it receives the right flow rate, if the manifold distributes evenly, if the pump is properly selected, if the water level remains stable and if the control system coordinates schedules, sensors, lighting and operating modes.

NOTE

The performance of a fountain head depends on flow rate, manifold balance, the pump, water level and the control system.

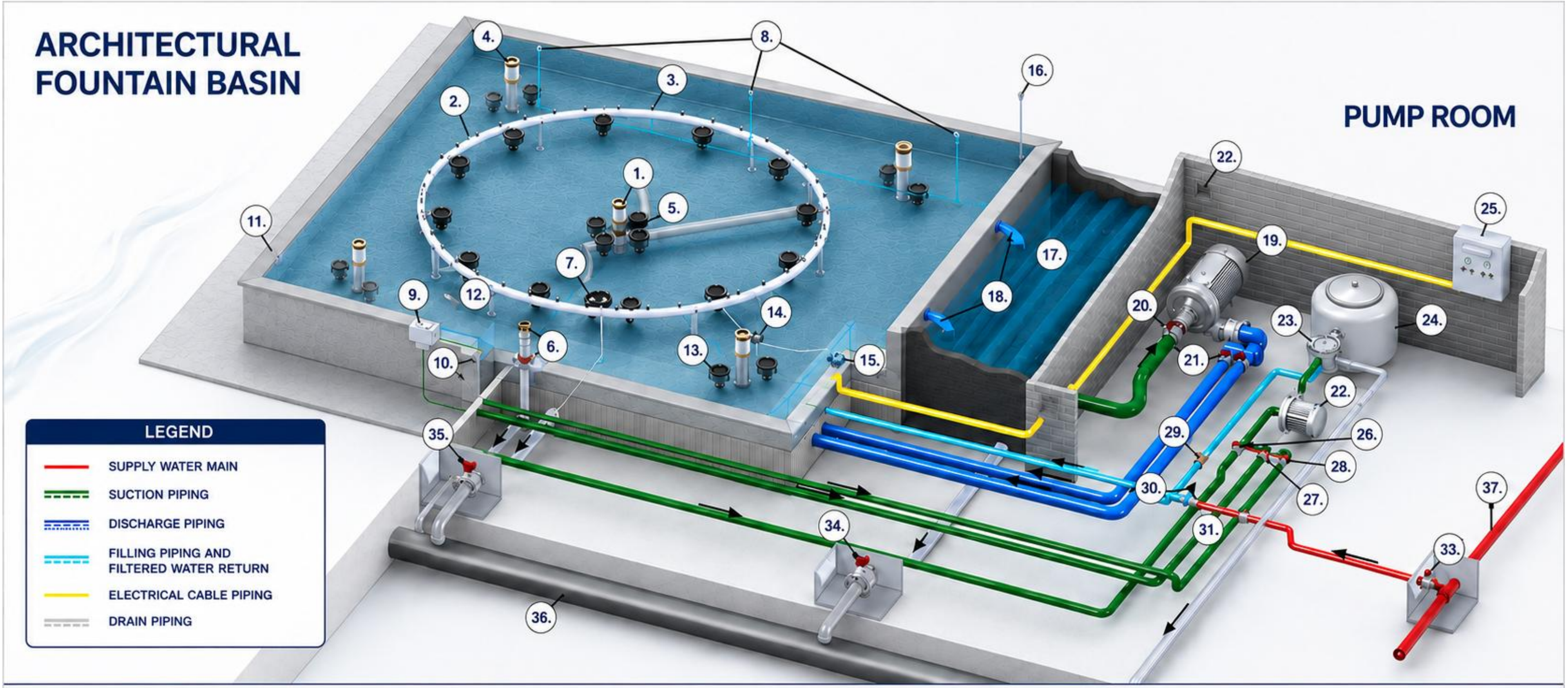
A system-based interpretation of the design

The design must start with a system-based interpretation: **each component performs a specific function, but also interacts with the rest** of the installation.

When this relationship is not considered from the design stage, problems may arise such as splashing, misaligned jets, maintenance difficulties, unnecessary consumption or loss of visual quality.

ATTENTION

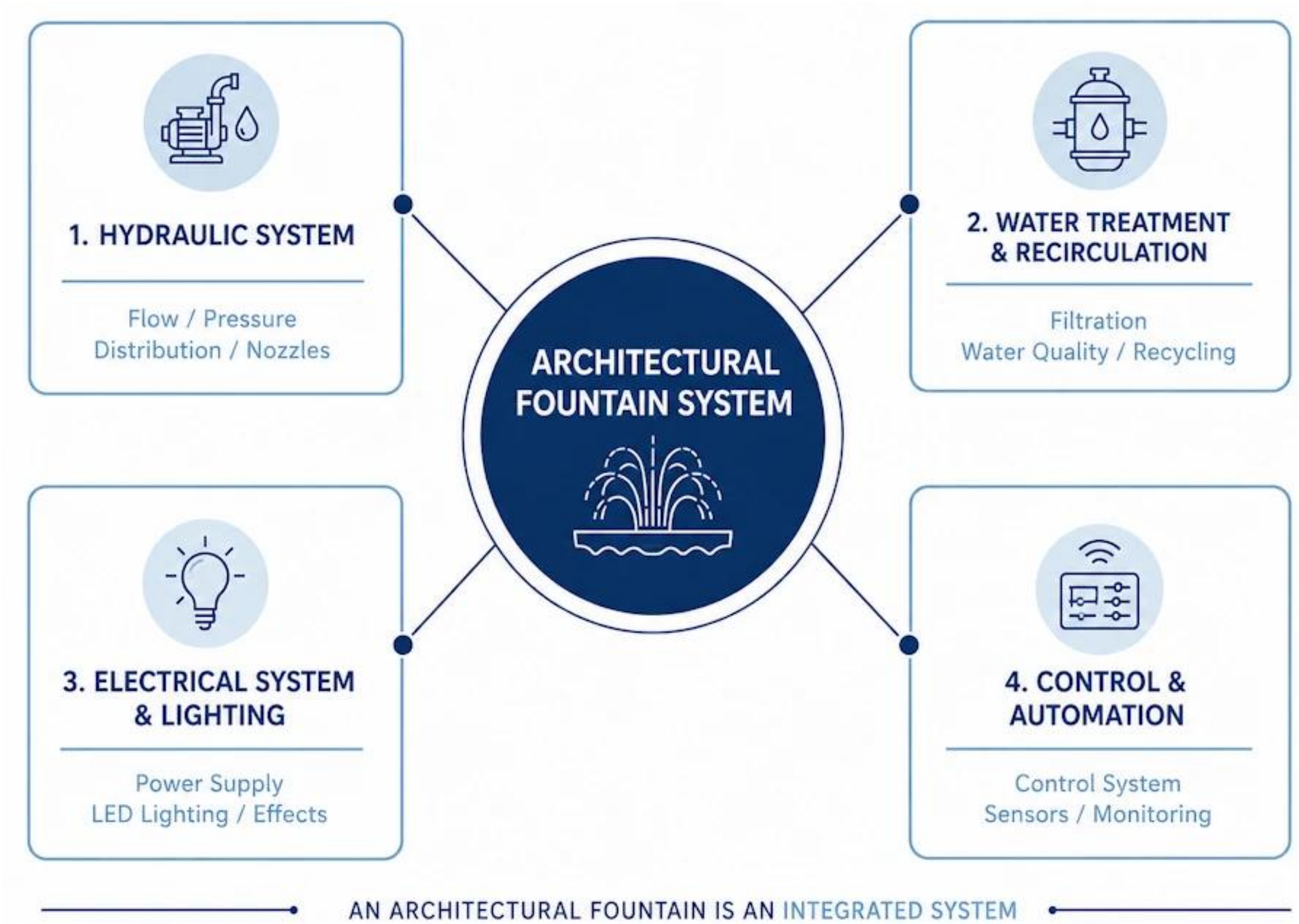
Failure to consider component interaction from the design stage can affect operation, maintenance, consumption and visual quality.



1. GEYSER NOZZLE
2. COLLECTOR RING
3. LANCE JET NOZZLES
4. SNOW JET NOZZLE
5. BALL-TYPE NOZZLE
6. OVERFLOW WEIR
7. BOTTOM DRAIN
8. DIRECTIONAL AND FILL NOZZLES
9. SKIMMER
10. BOTTOM CLEAN-OUT SUCTION
11. WATER LEVEL PROBE FOR BASIN REFILLING
12. FEET FOR COLLECTOR CONNECTION
13. IP-68 UNDERWATER LIGHTS WITH LED LAMP
14. IP-68 UNDERWATER JUNCTION BOX
15. IP-68 BULKHEAD FITTING
16. ANEMOMETER
17. AUXILIARY TANK
18. WATER INLET TO AUXILIARY TANK
19. ELECTRIC PUMP
20. CENTRIFUGAL PUMP
21. CHECK VALVE
22. PUMP DISCHARGE GATE VALVE
23. FILTER SELECTOR VALVE
24. SAND SILICA FILTER TANK
25. MANIFOLD CABINET FOR FOUNTAIN
26. BOTTOM DRAIN VALVE
27. SKIMMER VALVE
28. BOTTOM CLEAN-OUT ACCESS GRILLES
29. FILTERED WATER RETURN VALVE
30. SOLENOID VALVE FOR BASIN FILLING
31. RETENTION VALVE ON FILL INLET
32. VENTILATION GRILLES
33. SHUT-OFF VALVE
34. DRAIN VALVE FOR AUXILIARY TANK
35. DRAIN VALVE FOR FOUNTAIN BASIN
36. MAIN DRAIN PIPE
37. PUBLIC WATER SUPPLY MAIN

MAIN SYSTEMS OF AN ARCHITECTURAL FOUNTAIN

An architectural installation is organized around four major technical subsystems: **hydraulics**, **treatment and recirculation**, **electrical and lighting**, y **control and automation**.



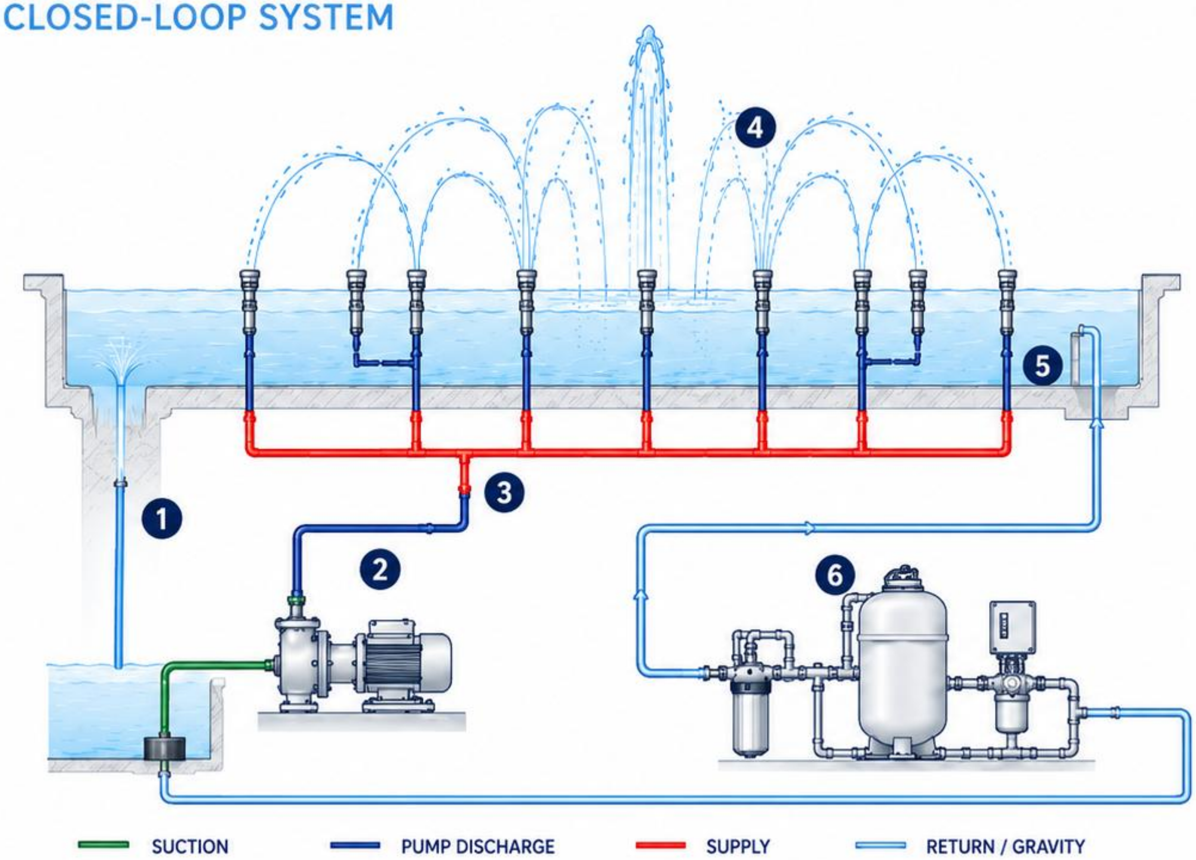
Hydraulic system

The **hydraulic system** is the **physical basis of operation** of the fountain. Its function is to draw water from the basin or auxiliary tank, pump it by means of electric pumps, distribute it through pipes and manifolds, and deliver it to the fountain heads with the required flow rate and pressure.

Essential aspects depend on this subsystem, such as the **uniformity of the water effects**, the overall visual stability, energy consumption and the installation response to wind.

HYDRAULIC OPERATION OF AN ARCHITECTURAL FOUNTAIN

CLOSED-LOOP SYSTEM



1 WATER COLLECTION FROM THE BASIN
Water is collected from the basin through bottom drains or side intake points.

2 PUMPING BY ELECTRIC PUMP
An electric pump delivers pressurized water to the distribution system.

3 UNIFORM DISTRIBUTION THROUGH MANIFOLDS
Water is distributed through manifolds to ensure consistent flow rate and pressure at all nozzles.

4 EFFECT GENERATION THROUGH NOZZLES
Water is discharged through the nozzles, creating the fountain's visual effects.

5 WATER RETURN TO THE SYSTEM
Water returns to the basin by gravity and is directed back to the suction system.

6 FILTRATION AND RECIRCULATION IN A CLOSED LOOP
The water passes through the filtration system for cleaning and returns to the basin, completing the hydraulic circuit.

EFFICIENT AND SUSTAINABLE SYSTEM

- Continuous Water Recirculation
- Controlled Water Quality
- Reliable and Automated Operation
- Optimized Consumption and Energy Efficiency

The diagram shows the **path of water inside an architectural fountain**, from intake in the basin to its return to the system through filtration and closed-loop recirculation

1. **Water intake from the basin:** water is collected from the fountain basin to start the system path.
2. **Delivery by electric pump:** the electric pump drives the water towards the operating circuit.
3. **Uniform distribution in manifolds:** water is distributed through the manifolds to feed the emission points.
4. **Effect generation through fountain heads:** the fountain heads transform the pumped water into the visible fountain effect.
5. **Water returns to the system:** water returns to the represented path to continue the cycle.
6. **Filtration and closed-loop recirculation:** the system includes filtration and recirculation to keep the water moving within the circuit.

IMPORTANT

The illustration shows a continuous sequence: intake, delivery, distribution, effect, return and recirculation.

Meaning of the colours in the diagram

- **Suction:** identifies the section through which water is drawn from the basin.
- **Delivery:** indicates the path of water driven by the electric pump.
- **Supply:** marks the water supply to the system shown.
- **Gravity return:** represents the return of water to the system by gravity.

Treatment and recirculation system

The **treatment and recirculation system** has the purpose of keeping the water in suitable conditions, both chemically and mechanically. To do this, it removes suspended solids and maintains a stable operating regime.

This subsystem includes a bottom drain, skimmer, directional fountain heads, filtration pump, sand filter, automatic filling, auxiliary tank, chemical treatments and drainage lines.

The design criterion is to work in a **closed loop**, replacing only losses caused by evaporation or splashing.

Electrical and lighting system

The **electrical and lighting system** powers underwater lights, sensors, actuators and the control panel.

The **lighting** should not be added at the end, but defined together with the hydraulics so that **colour, optics, power and control** are aligned with the water effect.

> **IMPORTANT**
>
> Lighting must be planned in coordination with hydraulics so that the water effect and lighting effect work in alignment.

Control and automation system

The **control and automation system** is the layer that coordinates the actual behavior of the whole system: schedules, sensors, sequences, automatic make-up water, lighting and height variation.

In simple installations, **basic logic**; in dancing, dry deck or interactive fountains, control becomes a **decisive infrastructure**.

The fountain must be designed as a complete system: hydraulics, treatment, electrical systems, lighting and control must be coordinated from the design stage to avoid later issues

> **ATTENTION**
>
> Selecting a fountain head, a pump or a control solution without reviewing the whole system can cause splashing, unnecessary consumption, maintenance problems or loss of visual quality.

COMPONENTS OF THE ARCHITECTURAL FOUNTAIN

The components of an architectural fountain can be **grouped by functional categories** to make it easier to understand the installation and its maintenance.

- Water emission and architectural components.
- Basin, intake, level and make-up water.
- Pumping and water delivery.
- Filtration, suction and return.
- Lighting, watertightness and control.
- Water supply, ventilation and drainage.

Water emission and architectural structure

Emission elements **transform the hydraulic flow into a visual effect**. Their correct selection and adjustment are decisive for architectural fountains to maintain uniformity, stability and visual quality during operation.

> **NOTE**
>
> The visual quality of the architectural fountain begins with the correct conversion of hydraulic flow into a water effect.

- **No. 1 – Geyser fountain head:** generates a white, foamy-looking jet by mixing pumped water, basin water and air. It depends on water level and requires access for cleaning, readjustment and coordination with schedules, anemometer or pump modulation.
- **No. 2 – Manifold ring:** distributes the pumped water to the fountain heads installed on it. In circular or geometric compositions, its balance determines jet homogeneity.
- **No. 3 – Lance jet fountain heads:** produce clear, well-defined jets, suitable for clean compositions. They require well-filtered water, stable flow and the possibility of periodic alignment using ball joints.
- **No. 4 – Snow jet fountain head:** produces a white, foamy and volumetric jet. Noise level, wind response and possible splashing should be assessed.
- **No. 5 – Ball joint:** allows the verticality or inclination of the jet to be adjusted. It must remain accesible and maintain a stable position.

> **ATTENTION**

For foamy and volumetric jets, noise, wind response and splashing risk should be reviewed.

Basin, intake, level and make-up water

This group brings together the **components that keep the basin in operating condition**: they control the level, facilitate water intake, support cleaning and ensure make-up water for evaporation or splashing losses.

- **No. 6 – Overflow:** evacuates water above the desired basin level, preventing overflows due to rain or higher-than-expected inflows.
- **No. 7 – Bottom drain:** allows the basin to be emptied and facilitates general maintenance, coordinating with slopes, the bottom drain valve and the main drain.
- **No. 8 – Directional and filling fountain heads:** supply water to the basin and, if correctly oriented, drive surface debris towards the skimmer.
- **No. 9 – Skimmer:** collects floating debris and channels it towards the filtration circuit. Positioning it against prevailing winds improves surface capture.
- **No. 10 – Suction fitting for bottom cleaner:** allows a hose and cleaner to be connected to vacuum debris deposited on the bottom.
- **No. 11 – Level probe:** detects level drops and activates the filling solenoid valve, helping to keep the working volume stable.
- **No. 12 – Feet for manifold fixing:** fix the manifold to the bottom of the basin and provide the appropriate height and level.
- **No. 17 – Auxiliary tank:** helps maintain the water level during operation and ensures the minimum depth required for the main pump.
- **No. 18 – Water inlet to the auxiliary tank:** connects the basin and auxiliary tank, helping to maintain system stability.

NOTE

The auxiliary tank helps stabilize the working volume and guarantee the depth required by the main pump.

Pumping and delivery system

The pumping system provides the hydraulic energy required to generate the water effects. Pumps and valves determine flow rate, pressure, regulation and ease of maintenance.

- **No. 19 – Main electric pump:** pumps water towards nozzles or fountain heads. Its selection must be based on the total flow rate and the required dynamic head.

- **No. 20 – Gate valve on suction:** allows the unit to be isolated for maintenance or replacement without emptying the basin.
- **No. 21 – Gate valve on delivery:** allows flow rate or pressure to be adjusted towards fountain heads and manifolds during commissioning.

IMPORTANT

The selection of pumps and valves affects both the water effect and system regulation and maintenance.

Filtration, suction and return

Filtration keeps the water in suitable condition through intake, mechanical treatment and return to the basin. It also facilitates daily operation and reduces issues related to surface debris, sediment or unwanted backflows.

NOTE

Water quality depends on effective intake, correct mechanical treatment and proper return to the basin.

- **No. 22 – Filtration electric pump:** pumps water to the sand filter and returns filtered water to the basin.
- **No. 23 – Multiport valve:** allows functions such as filtration, backwashing, rinsing, recirculation, closed position or drainage to be selected.
- **No. 24 – Silica sand filter tank:** retains impurities and returns clean water to the basin.
- **No. 26 – Bottom drain valve:** allows the fountain to be emptied for maintenance tasks that could not otherwise be performed.
- **No. 27 – Skimmer valve:** regulates surface suction towards the filtration system.
- **No. 28 – Bottom cleaner valve:** allows debris deposited on the bottom to be vacuumed and sent to the filtration system.
- **No. 29 – Check valve on filtered return:** prevents filtered water from returning to the silica sand tank.

Lighting, watertightness and control

Lighting, watertight connections and control devices **extend the functionality of the fountain** and make it possible to coordinate water, light, sensors and automation.

- **No. 13 – IP-68 LED underwater lights:** illuminate the fountain from inside the basin and allow different colours to be generated using DMX control.

- **No. 14 – IP-68 underwater junction box:** allows electrical connections for submerged elements while maintaining watertightness.
- **No. 15 – IP-68 wall conduit:** allows cables to pass from outside to inside the basin without water ingress.
- **No. 16 – Anemometer:** controls operation according to wind speed and can reduce or cancel the height of the jets.
- **No. 25 – Control panel:** programmes hydraulic and lighting operation, centralizing pumps, lighting, sensors, automation and filtration.
- **No. 30 – Filling solenoid valve:** allows automatic filling of the basin or auxiliary tank in coordination with the level probe.

Water supply, ventilation and drainage

These components **connect the installation to the external supply**, ensure **water evacuation** y **protect the plant room**. Although they are often perceived as auxiliary elements, they are decisive for hydraulic safety, maintainability and long-term operation.

> **IMPORTANT**
>
> The reliability of these elements affects hydraulic safety, ease of maintenance and continuous operation of the installation.

- **No. 31 – Check valve on filling inlet:** prevents water from the fountain from returning to the supply network.
- **No. 32 – Ventilation grilles:** allow natural ventilation of the pump room and reduce condensation.
- **No. 33 – Supply valve:** connects the installation to the public network and allows manual control of the water supply.
- **No. 34 – Auxiliary tank drain valve:** allows the compensation volume to be emptied for cleaning or intervention.
- **No. 35 – Fountain drain valve:** allows the basin to be emptied through the bottom drain.
- **No. 36 – Main drain pipe:** collects and conveys system drainage outside the installation.
- **No. 37 – Public water supply network:** provides water for filling and make-up of the system.

HOW THE LIGHTING AND CONTROL SYSTEM WORKS

INTELLIGENT CONTROL · COORDINATED LIGHTING · MAXIMUM PERFORMANCE

1 CONTROL PANEL

Centralizes fountain operation

2 PROGRAMMING

Defines scenes, schedules and sequences

SCHEDULES

SEQUENCES

3 CONTROL SIGNALS

Transmit commands to devices through different control protocols

Modbus

DMX512

MODBUS / DMX CONTROL SIGNAL (depending on version)

4 UNDERWATER LED LIGHTS

Project light onto the water

5 LIGHTING EFFECT

Coordinated final visual effect

PRECISE CONTROL
Complete synchronization between water, lighting and music

FLEXIBLE PROGRAMMING
Custom scenes, schedules and calendars

ENERGY EFFICIENCY
Smart control and management of energy consumption

SAFETY AND RELIABILITY
Continuous monitoring and automatic response

6 SENSORS

Adapt the system in real time (wind, water level, conditions)

ANEMOMETER

WATER LEVEL

ENVIRONMENTAL CONDITIONS

...

MAIN CONTROL FLOW

SENSOR FEEDBACK

INTELLIGENT, COORDINATED AND ADAPTABLE SYSTEM

Technology that transforms water into unique, safe and sustainable experiences.

DESIGN CRITERIA

Correct hydraulic sizing

The pump, valves, manifold and fountain heads must be defined as an **integrated technical set**. The total flow rate, dynamic head, head losses and regulation determine directly the quality of the effect.

Automation at the appropriate level

The control system must **address schedules, sensors, lighting and safety** without adding unnecessary difficulty. In interactive, dry deck or dynamic fountains, this layer requires special attention from the design stage.

Maintenance-oriented design

Maintainability is decided in specific details: accessibility of pumps and valves, skimmer cleaning, access to connections, plant room ventilation, clear drainage points and ease of readjusting fountain heads.

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>
> Maintainability is decided in specific details: accessibility of pumps and valves, skimmer cleaning, access to connections, plant room ventilation, clear drainage points and ease of readjusting fountain heads.

AUTOMATION AND CONTROL

Function of the control system

The control system **does not replace hydraulics or lighting: it coordinates them**. In current installations it defines when the system operates, how it responds to wind, how make-up water is supplied, how lighting is programmed and what degree of dynamism it can handle.

Technology adjustment according to the fountain type

Control technology must be adapted to the fountain type. A **classic architectural fountain** composition needs pump control and protection, schedules and simple lighting. A **dynamic fountain** basic dynamic fountain may require more water pumps, preconfigured programs, level control and an anemometer. Advanced installations incorporate multiple hydraulic circuits, variable frequency drives, DMX, custom programming, remote control and, in dancing or musical fountains, synchronization between water, light and music.

Complexity criterion

The important decision is not to add complexity, but to **choose the right complexity**. An overly basic system limits operation; an excessively sophisticated one can complicate maintenance and operation if it does not match the real fountain type.

IMPORTANT

The key is to match the technology level to the real type of architectural fountain

Choose the right control system for your fountain

Automation must match the complexity of the installation

Essential

- Basic operation
- Fixed control logic
- Ideal for simple fountains

Essential Plus

- Extended automation
- Basic sensor integration
- Suitable for small dynamic fountains

Smart Fountain Manager Pro

- Dynamic water control
- Partial lighting control
- Advanced programming
- Suitable for Dynamic fountains

Smart Fountain Manager Pro Max

- Full DMX system control
- Sensors and automation integration
- Real-time monitoring
- Scalable architecture
- Suitable for dancing fountains

Smart Fountain Manager Pro Max Music

- Full DMX synchronization with music
- Water, lighting and audio integration
- Advanced show programming
- Maximum system performance
- Suitable for musical dancing fountains

Low complexity → High complexity

Advanced control system

FINAL RECOMMENDATIONS FOR A RELIABLE DESIGN

Common mistakes to avoid

- **Designing without a system view:** choosing fountain heads or lighting without reviewing manifolds, pumping, water level and control usually creates operating problems.
- **Integrating control too late:** when sensors, panels, variable frequency drives and lighting are not coordinated from the start, the installation loses flexibility and becomes more difficult to operate.
- **Neglecting hydraulic or maintenance decisions:** poorly accessible valves, poorly resolved drainage, deficient surface distribution or insufficient filtration affect the operational service life of the whole system.

ATTENTION

The selection of fountain heads or lighting must be evaluated together with manifolds, pumping, water level and control to avoid operating problems.

Conclusion

The success of architectural fountains depends on the balance between all their components. The visual quality of the water is only the visible part of a broader engineering system made up of hydraulics, treatment, lighting, sensors, automation, drainage and maintenance.

IMPORTANT

The final quality of an architectural fountain depends on the coordination between all the systems that make it up.

When each element is selected and positioned with the complete system in mind, the installation works better, consumes resources more efficiently, is easier to maintain and can adapt to different operating modes.

That is the difference between a composition of parts and a **coherent technical solution** for urban, public and architectural projects.

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