Meeting Minutes: How To Caculate The Filter Element Quantity Per The Filtration System Flow Requirements?

Meeting Topic: Filtration System Flow Requirements and Filter Element Quantity Calculation Specifications

Core Meeting Content: Clarify the filtration system flow selection, filter element quantity calculation methods and filter element replacement standards, standardize on-site application processes, and ensure stable operation of the system.

I. Calculate Filter Element Related Parameters Based on Initial Pressure Drop

1.1 Initial Clean Pressure Drop Control Standard: The initial clean pressure drop is generally controlled within 0.5 psi. In practical applications, priority can be given to referring to the pressure drop-flow curve provided by the filter element supplier, or it can be calculated by the following formula.

1.2 Calculation Basis and Formula Explanation: Calculated based on the Specific Pressure Drop (SPD) method of filter element supplier Micro-Klean. Specific Pressure Drop (SPD) is defined as the pressure drop (psid) generated by a 10-inch long filter element under a flow rate of 1 gallon per minute (gpm) of a 1 centipoise (Cp) viscous fluid.

1.3 Calculation Formula:

Clean Pressure Drop Δp (psid or mbar) = [Total System Flow (gpm or lpm) × Fluid Viscosity (Cp) × SPD Value Corresponding to Filter Grade] ÷ Total Number of 10-inch Equivalent Length Filter Elements

1.4 Key Conversion Standards:

- 40-inch filter element = 4 pieces of 10-inch equivalent length
- 20-inch filter element = 2 pieces of 10-inch equivalent length

1.5 Filter Element SPD Parameter Comparison Table:

Nominal Rating (μm)	SPD Value (psid/gpm·Cp)	SPD Value (mbar/lpm·Cp)

1	0.3254	5.93
3	0.2034	3.71
5	0.1271	2.32
10	0.0712	1.30
25	0.0356	0.65
50	0.0224	0.41
75	0.0142	0.26
100	0.0092	0.17

II. Estimate Filter Element Quantity and Flow Rate Based on Filtration Area

2.1 Filtration Flux Standard: The filtration flux shall be determined according to water quality and filter element material. Under normal working conditions (with water as the medium and density calculated as 1t/m³), the forced filtration flux is recommended not to exceed 10 m³/(m²·h), which is equivalent to 10 t/(m²·h).

2.2 Calculation Example: For a conventional filter element with an outer diameter of 63mm and a length of 40 inches, its filtration area is about 0.2 m². According to the above flux standard, the allowable flow rate of a single filter element is: 0.2 m² × 10 m³/(m²·h) = 2 m³/h (i.e., 2 t/h).

2.3 Notes: When the water quality is poor (high turbidity and high impurity content), the filtration flux should be appropriately reduced to avoid rapid clogging of the filter element and extend the service life of the filter element.

III. Estimate Filter Element Quantity and Flow Rate Based on Empirical Values

3.1 Reference for Empirical Flow Rate of a Single Filter Element (Based on Conventional Industry Application Scenarios):

- PP melt-blown/wound filter element with an outer diameter of 2.5 inches and a length of 10 inches: The recommended operating flow rate is about 0.5 m³/h;
- PTFE/PES precision filter element of the same specification (outer diameter 2.5 inches, length 10 inches): The recommended operating flow rate is about 0.2~0.3 m³/h (the flux is slightly lower due to the higher precision of the precision filter element);

- Large-flow pleated filter element with an outer diameter of 6 inches and a length of 40 inches: The recommended operating flow rate is about 15~20 m³/h.

3.2 Balanced Principle for Filter Element Quantity Selection:

- Under the same system flow rate, the more filter elements there are, the smaller the initial pressure drop, the smaller the head loss of the filter pump, the longer the filter element clogging cycle, and the longer the service life of the filter element;
- The number of filter elements is not as many as possible. Too many will increase the filter element purchase cost, replacement labor time, and waste filter element disposal cost;
- The length and quantity of filter elements shall be combined with on-site actual working conditions (water quality, operation cycle requirements), and iteratively optimized through later operation data to achieve a balance between performance and cost.

IV. Filter Element Replacement Pressure Drop Setting Standard

4.1 Reference Value for Replacement Pressure Drop: Under normal temperature working conditions, the filter element replacement pressure drop is generally set to 35 psi; when the operating temperature is ≥60℃, it is recommended to reduce the replacement pressure drop to 25 psi (increased temperature will reduce the pressure-bearing safety margin of the filter element and filter housing).

4.2 Filter Element Replacement Judgment Principle: It shall be judged by combining the pressure drop and effluent water quality, as follows:

- When the system pressure drop reaches the set replacement value, the filter element shall be replaced first;
- If the system pressure drop does not reach the set value, but the effluent water quality (such as turbidity, SDI and other indicators) is not up to standard, the filter element shall be replaced in advance.

4.3 Optimization Suggestion: During the later system commissioning and operation, the initially set replacement pressure drop can be corrected by accumulating actual operation data to establish a filter element replacement standard suitable for on-site working conditions.

V. Supplementary Instructions

5.1 All calculation methods and empirical values in this meeting minutes are based on clean water/low viscosity fluid working conditions; for special working conditions such as high viscosity, oil-containing, and high impurity, parameters shall be calculated separately.

5.2 Unit Conversion Reference: 1 gpm (gallon per minute) ≈ 0.227 m³/h (cubic meter per hour), which is convenient for on-site personnel to quickly convert and use.

5.3 The "pressure drop" mentioned in this record refers to the pressure drop before and after the filter element, not the total system pressure drop, which shall be distinguished during on-site operation.

5.4 If you have any questions or don't know how to calculate, it's okay. You can contact us at any time, and we can provide you with calculation and selection support. Our website is www.vwalve.com, and The email address is inquiry@vwalve.com