

INDUSTRIAL PIPELINE STRAINERS

Engineering guide to selection, materials, straining elements, sizing, hydraulics, installation, operation and maintenance

Industrial Pipeline Strainers

Engineering Handbook

A practical technical reference for engineers who specify, select, procure, install, operate and maintain strainers in industrial piping systems.

How to use this handbook

Start with the service condition and protection requirement, then move through strainer type, materials, element selection, hydraulics, mechanical integrity and maintenance. Reference tables are provided for quick engineering review.

Design basis

Manufacturer-specific pressure ratings, hydraulic performance, element collapse limits and dimensions must be confirmed against certified manufacturer data, the governing design code and the project specification.



ENGINEERING DISCLAIMER

This handbook provides engineering guidance and does not replace the applicable design code, project specification, piping class, statutory requirement or certified manufacturer data.

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PART I

FUNDAMENTALS

What a pipeline strainer is, why it is installed, how it works, and how the principal types are selected.

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| 1 | Definition, Purpose and Working Principle |
| 2 | Types of Industrial Pipeline Strainers |
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1 DEFINITION, PURPOSE AND WORKING PRINCIPLE

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The fundamental engineering function of the pipeline strainer.

1.1 Definition - Pipeline Strainer

A pipeline strainer is a mechanical separation device installed in a piping system to remove and retain suspended solid particles from a flowing fluid by directing the fluid through a perforated plate, woven wire mesh, wedge-wire, or other engineered straining element having controlled openings.

Particles larger than the effective opening of the straining element are retained within the strainer, while the fluid and smaller particles pass downstream.

Pipeline strainers are primarily used for protection of downstream piping components and process equipment from blockage, erosion, fouling, wear, or malfunction caused by entrained debris.

Depending on the straining-element construction, pipeline strainers are commonly applied over a broad retention range, from approximately 25 mm (1 in) down to about 40 μm , with finer retention possible in specialized designs.

1.2 Purpose and Functions

The primary purpose of a pipeline strainer is to protect downstream equipment and piping components from damage, blockage, fouling, erosion and operational malfunction caused by unwanted solid particles carried by the process fluid.

During fabrication, installation, commissioning and normal operation, piping systems may contain or generate weld slag, mill scale, rust, metal particles, sand, gasket fragments, process solids and other foreign debris. If allowed to travel downstream, these contaminants can impair sensitive equipment.

- Protect pumps and compressors from damaging solids and wear particles.
- Protect control valves, regulators and flowmeters from obstruction, trim damage and fouling.
- Protect heat exchangers, condensers, steam traps, nozzles and instrumentation from blockage.
- Provide a controlled location where retained solids can be collected and removed.
- Maintain system reliability by preventing debris-related failures before they occur.

ENGINEERING PRINCIPLE

A strainer should retain only the particles that can adversely affect the protected equipment. Unnecessarily fine retention increases pressure drop and cleaning frequency without necessarily increasing useful protection.

1.3 Working Principle

A pipeline strainer operates on the principle of mechanical separation by size exclusion. Process fluid enters the body and is directed through a straining element with controlled openings. Particles too large to pass are retained; the strained fluid continues downstream.

As solids accumulate, effective open flow area decreases, local velocity through the remaining openings increases, differential pressure rises and the hydraulic resistance of the strainer increases.

- Opening size and geometry determine the nominal retention duty.
- Effective open area influences hydraulic capacity and loading margin.
- Particle size, shape, concentration and character influence capture and cleaning behavior.
- Element material and support determine resistance to differential-pressure loading.
- Cleaning method and frequency determine how long the strainer can operate safely between interventions.

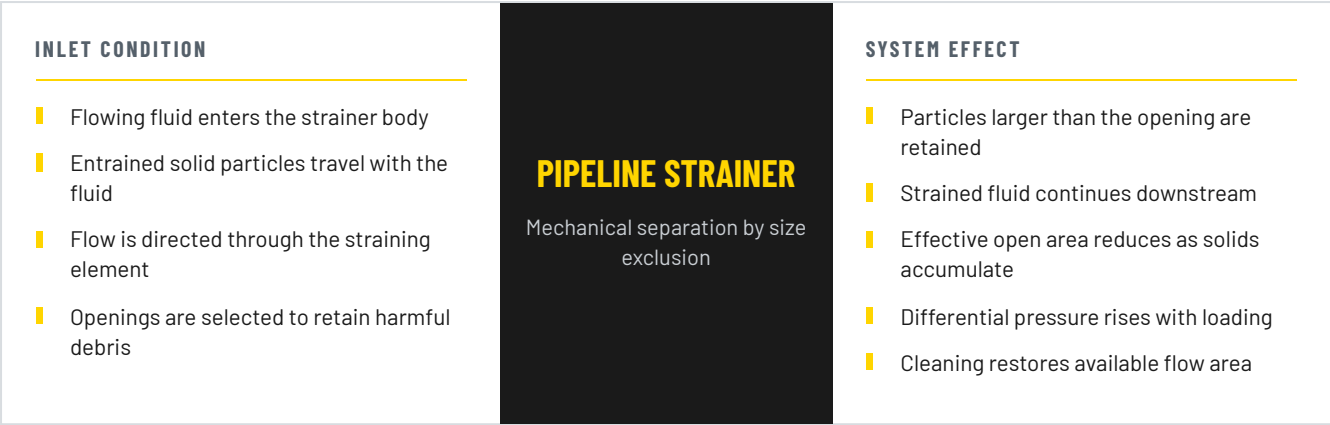


Figure 1.1 Working principle: contaminated fluid passes through a controlled opening; retained solids reduce effective area and increase differential pressure until cleaning is required.

Figure 1.1: Working principle: contaminated fluid passes through a controlled opening; retained solids reduce effective area and increase differential pressure until cleaning is required.

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TYPES OF INDUSTRIAL PIPELINE STRAINERS

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Principal configurations and the service condition each is intended to solve.

Type	Principal Feature	Typical Use
Y Strainer	Compact inclined element pocket	Steam, gas, liquids, higher pressure and restricted-space duties
Simplex Basket Strainer	Single removable basket with relatively large screen area	Liquid service, higher solids loading and longer cleaning intervals
Duplex Strainer	Two changeover chambers	Continuous operation during manual cleaning
Tee Strainer	Straight-through or angle body with removable element	Compact layout, right-angle flow or convenient top access
Temporary / Conical Strainer	Cone, truncated cone or flat element between flanges	Flushing, commissioning and start-up debris
Automatic Self-Cleaning Strainer	Automated debris-removal mechanism	High or variable loading where manual cleaning is impractical
Wafer / Plate Strainer	Very short face-to-face screen between flanges	Space-limited or temporary/coarse protection
High-Capacity Strainer	Enlarged body and element area	Viscous fluids, heavy solids or long cleaning interval
Micronic / Fine-Mesh Strainer	Fine reusable mesh with robust support and sealing	Fine retention where reusable element remains practical

2.1 Selection Characteristics

The strainer type should not be selected from line size or precedent alone. Body configuration is only one part of the selection. The engineer must also check hydraulic capacity, element area, process continuity and maintenance access.

IMPORTANT DISTINCTION

Duplex selection is driven primarily by process continuity. Automatic self-cleaning selection is driven primarily by loading, cleaning frequency and operating practicality.

3 STRAINER SELECTION - WHEN AND WHAT TYPE

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A condition-based engineering selection sequence.

The correct strainer is the one that satisfies the process duty, debris characteristics, hydraulic limits, mechanical conditions and maintenance philosophy together.

Condition	Preferred Type	Reason
Commissioning / flushing	Temporary / conical	Capture construction debris economically; define removal criterion
High pressure / compact space	Y strainer	Compact construction; suitable high-pressure configurations available
Liquid service / significant solids	Simplex basket	Higher screen area and dirt-holding capacity
Process cannot stop for cleaning	Duplex	One chamber remains in service while the other is cleaned
High or unpredictable solids loading	Automatic self-cleaning	Reduces manual intervention and unplanned blockage
Compact straight-through arrangement	Tee strainer	Useful where geometry or top access controls the layout
Very short face-to-face space	Wafer / plate	Minimum installed length
Viscous fluid / long interval required	High-capacity basket	Lower element velocity and greater solids capacity
Fine reusable retention	Mesh-supported / micronic configuration	Use only where sealing, support and loaded ΔP are acceptable

3.1 Selection Sequence

1. Define fluid phase and properties: liquid, gas, steam, viscosity, density and temperature.
2. Define contaminants: particle size, loading, shape, abrasiveness, fibrous/adherent character and variability.
3. Define the protection requirement from the downstream equipment sensitivity.
4. Establish whether the process can stop for cleaning.
5. State allowable clean and loaded differential pressure.
6. Verify body pressure-temperature capability and element differential-pressure strength.
7. Confirm orientation, access, isolation, drainage, lifting clearance and cleaning method.
8. Compare manufacturer hydraulic and dimensional data before final approval.

3.2 Selection Output

A completed preliminary selection should identify: strainer type + nominal size + element medium + opening size + effective open area/OAR basis + clean and loaded ΔP + element differential-pressure limit + cleaning method + maintenance clearance.

Use the mind map to screen options; use manufacturer hydraulic and dimensional data to make the final equipment selection.

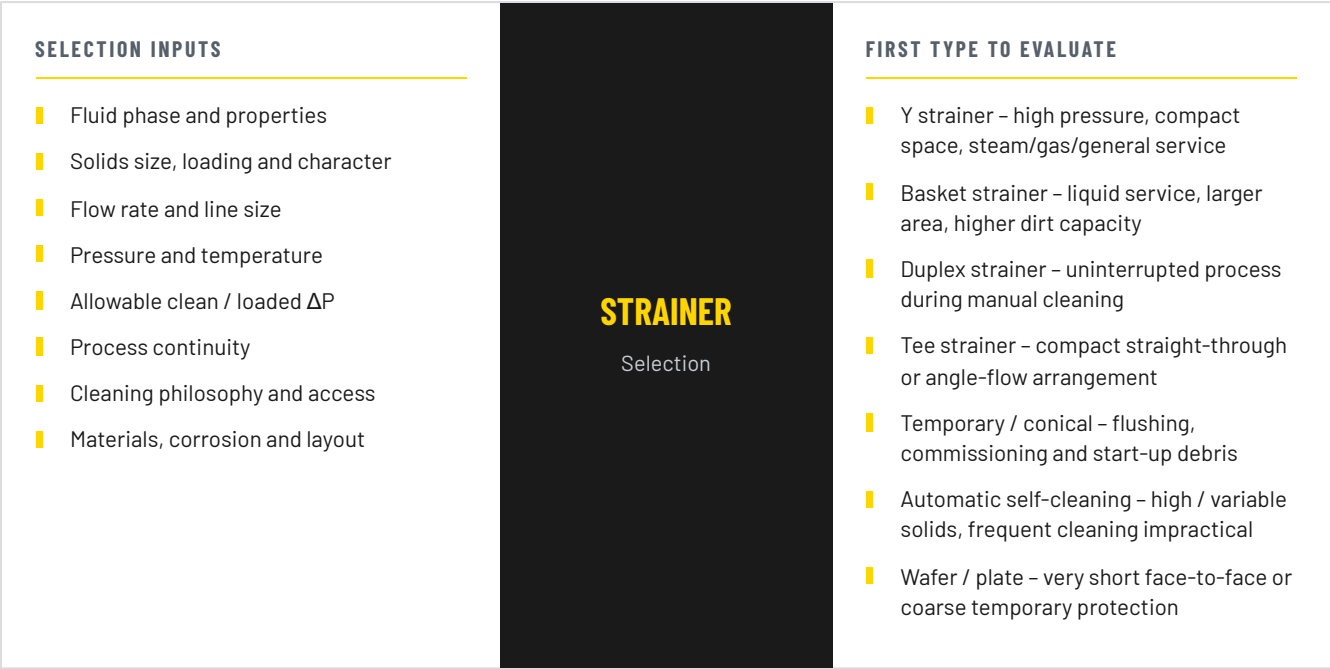


Figure 3.1 - Condition-based strainer selection map. Final selection requires manufacturer hydraulic, dimensional and mechanical verification.

STRAINER

SELECTION

Figure 3.1: Condition-based strainer selection map. Final selection requires manufacturer hydraulic, dimensional and mechanical verification.

PART II

CONSTRUCTION AND MATERIALS

End connections, product forms, corrosion control and straining-element construction.

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END CONNECTIONS AND INTERNATIONAL STANDARDS

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Connection type must match the piping class, pressure-temperature duty and maintenance requirement.

End Connection	Typical Application	ASME / US	EN / ISO	JIS	IS / BIS
Flanged - steel	General industrial service; removable connection	ASME B16.5 / B16.47	EN 1092-1 / ISO 7005-1	JIS B 2220	IS 6392
Flanged - cast / ductile iron	Water and utility service	ASME B16.1 / B16.42	EN 1092-2 / ISO 7005-2	Applicable JIS	Applicable BIS
Threaded - NPT	Small-bore general service	ASME B1.20.1; ASME B16.11 components	-	-	-
Threaded - BSPT	Small-bore Europe/Asia service	-	EN 10226-1 / ISO 7-1	JIS B 0203	IS 554
Socket weld	Small-bore high-pressure / leak-tight service	ASME B16.11	Project-specific / ASME often used	Project-specific	Project-specific
Butt weld	High pressure/temperature; permanent joint	ASME B16.25	EN 12627 / project piping standard	Project-specific	Project-specific
Grooved	Water, HVAC, fire-water and utility piping	AWWA C606 where applicable	Project-specific	Project-specific	Project-specific
Wafer / sandwich	Short face-to-face installation	Mating flange standard	Mating flange standard	Mating flange standard	Mating flange standard

PRESSURE-RATING CAUTION

The end-connection class is not automatically the pressure rating of the complete strainer. Body, cover joint, gasket, bolting, end connections and other applicable pressure-boundary components must be verified at design pressure and temperature.

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MATERIALS OF CONSTRUCTION

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Material selection is component-specific and product-form-specific.

5.1 Component Material Requirements

Component	Primary Requirement	Typical Material Families
Body / housing	Pressure containment, corrosion resistance, temperature capability	Cast iron, ductile iron, carbon steel, LTCS, stainless, duplex, nickel alloys
Cover / bonnet	Pressure containment and repeated opening	Normally compatible with body material
Straining element	Retention, erosion resistance, differential-pressure strength	SS304/304L, SS316/316L, duplex, Monel, nickel alloys, CS where suitable
Perforated support	Mechanical backing against collapse	Stainless steel, carbon steel, duplex or alloy material
Fasteners	Strength, temperature and corrosion resistance	Carbon steel, alloy steel, stainless, duplex, nickel alloys

Component	Primary Requirement	Typical Material Families
Gasket / seals	Pressure sealing and fluid/temperature compatibility	Graphite, spiral wound, PTFE, elastomers, metallic gaskets
Drain / blowdown	Pressure integrity and fluid compatibility	Normally compatible with body / piping class

5.2 Product Form - Casting, Forging and Plate

Material Family	Casting	Forging	Plate	Typical Application
Carbon steel	A/SA216 WCB / WCC	A/SA105	A/SA516 Gr 60/65/70	General process, steam, oil & gas
Low-temperature carbon steel	A/SA352 LCB / LCC	A/SA350 LF2	Project/code-approved low-temperature plate; impact requirements to be specified	LPG and low-temperature service
SS 304	A/SA351 CF8	A/SA182 F304	A/SA240 304	General corrosion-resistant service
SS 304L	A/SA351 CF3	A/SA182 F304L	A/SA240 304L	Welded corrosion-resistant service
SS 316	A/SA351 CF8M	A/SA182 F316	A/SA240 316	Chemical and process service
SS 316L	A/SA351 CF3M	A/SA182 F316L	A/SA240 316L	Chemical, pharmaceutical and welded service
Duplex 2205 family	A995/A890 duplex casting grade selected to chemistry	A/SA182 F51 or F60 as applicable	A/SA240 S31803 / S32205	Chloride, seawater, offshore
Super duplex 2507	A995/A890 super-duplex grade selected to chemistry	A/SA182 F53	A/SA240 S32750	Severe chloride / seawater
Super duplex S32760	Approved super-duplex casting grade	A/SA182 F55	A/SA240 S32760 where applicable	Severe offshore / corrosive service

MATERIAL GRADE AND PRODUCT FORM ARE INSEPARABLE

A casting, forging and plate may belong to the same alloy family but are certified to different product specifications. A216 WCB, A105 and A516 Gr 70 are all carbon-steel product forms, but they are not interchangeable specifications.

5.3 International Comparison - Identification Only

Product Form	ASTM / ASME	EN	JIS	IS / BIS
Carbon steel casting	A216 WCB	EN 10213 GP240GH / 1.0619	JIS SCPH2 family	IS 1030 appropriate grade

Product Form	ASTM / ASME	EN	JIS	IS / BIS
Carbon steel forging	A105	EN 10222 family / P250GH family	Applicable pressure forging grade	IS 2004 appropriate class
Carbon steel plate	A516 Gr 70	EN 10028-2 pressure-vessel plate family	JIS G3118 SGV family	IS 2002 pressure-vessel plate family
304 stainless casting	A351 CF8	1.4308 family	SCS13 family	Project-specific
316 stainless casting	A351 CF8M	1.4408 family	SCS14 family	Project-specific
316L stainless casting	A351 CF3M	1.4409 family	SCS16A family	Project-specific
304 stainless plate	A240 304	1.4301	SUS304	IS 6911 family
316L stainless plate	A240 316L	1.4404	SUS316L	IS 6911 family

EQUIVALENCE WARNING

Cross-standard tables are for identification and enquiry. Do not substitute pressure-boundary materials solely from nominal equivalence; verify chemistry, mechanical properties, heat treatment, impact requirements, product form, design-code acceptance and project requirements.

6 CORROSION, EROSION, LININGS AND COATINGS

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The body and element can experience different corrosion and erosion mechanisms.

Mechanism	Where It Matters	Engineering Response
General corrosion	Uniform metal loss	Corrosion allowance, material upgrade, coating/lining
Pitting	Chloride-bearing or stagnant service	Suitable stainless/duplex/nickel alloy; control deposits
Crevice corrosion	Element seats, gaskets, deposits	Material selection, drainage and cleanable geometry
Stress-corrosion cracking	Chloride/caustic + stress + temperature	Material and hardness control; suitable alloy
Galvanic corrosion	Dissimilar wetted metals	Compatibility review; isolate or select compatible alloys
Erosion-corrosion	High local velocity / abrasive debris	Increase area, reduce local velocity, upgrade element material
Coating degradation	Incompatible chemistry or cleaning method	Select coating for both service and maintenance regime

The straining element often experiences higher local velocity than the body. Consequently, an element material acceptable by chemistry alone may still be inadequate where abrasive solids or high differential pressure are present.

SEPARATE MATERIAL CHECK

Select the body for pressure-temperature duty and corrosion compatibility. Select the element separately for retention, erosion, differential pressure, support construction and repeated cleaning.

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STRAINING ELEMENTS - PERFORATED PLATE, MESH AND WEDGE WIRE **CONTENTS**

Opening size controls retention; open area controls hydraulic capacity; support controls strength.

Element	Opening Form	Retention	Strength	Cleaning	Typical Duty
Perforated plate	Discrete round/square/slotted holes	Coarse to medium	High	Good	General industrial straining
Woven wire mesh	Opening between woven wires	Medium to very fine	Low without support	Can blind	Fine retention
Wedge wire	Continuous slot	Fine to coarse depending slot	High	Good for suitable debris	Backwash / low-blinding duty
Mesh + perforated support	Fine mesh over structural plate	Fine	Composite strength	Depends on debris	Fine retention with differential-pressure support

7.1 Perforated Plate - Typical Round-Hole Data

Hole Diameter (in)	Centre Spacing (in)	Open Area (%)
0.020	0.043	20
0.027	0.066	17
0.033	0.077	20
0.045	0.086	28
0.057	0.121	25
0.062	3/32	41
0.094	5/32	33
0.100	5/32	37
1/8	3/16	40
5/32	3/16	63
3/16	1/4	51
1/4	3/8	40
5/16	7/16	47
3/8	1/2	51

Hole Diameter (in)	Centre Spacing (in)	Open Area (%)
7/16	19/32	49
1/2	11/16	48
5/8	13/16	54
3/4	1	51

ROUND-HOLE FORMULA - 60° STAGGERED

OA (%) = $90.69 \times (d/p)^2$, where d is the hole diameter and p is the centre-to-centre pitch. Hole size alone does not define open area; pitch and pattern are equally important.

7.2 Woven Wire Mesh - Square Weave Reference

Mesh	Wire Dia. (in)	Clear Opening (in)	Opening (μm)	Open Area (%)
2	0.063	0.437	11100	76.4
2	0.092	0.407	10360	66.6
3	0.063	0.270	6860	65.6
4	0.047	0.208	5160	65.9
4	0.063	0.187	4750	56.0
5	0.041	0.159	4040	63.2
6	0.035	0.132	3350	62.7
7	0.035	0.108	2740	57.2
8	0.028	0.097	2460	60.2
10	0.025	0.075	1905	56.3
11	0.018	0.073	1850	64.5
12	0.023	0.060	1520	51.8
14	0.020	0.051	1300	51.0
16	0.018	0.044	1130	50.7
18	0.017	0.038	980	48.3
20	0.016	0.034	872	46.2
30	0.013	0.020	513	37.1
40	0.010	0.015	384	36.0
50	0.009	0.011	282	30.3
60	0.007	0.009	231	33.9

Mesh	Wire Dia. (in)	Clear Opening (in)	Opening (μm)	Open Area (%)
80	0.005	0.0075	180	36.0
100	0.0045	0.0055	141	30.0
120	0.0037	0.0046	118	30.1
150	0.0026	0.0041	105	37.4
170	0.0024	0.0035	79	35.1
200	0.0021	0.0029	74	33.6
250	0.0016	0.0024	62	36.0
300	0.0015	0.0018	46	29.7
325	0.0014	0.0017	44	30.0
400	0.0010	0.0015	39	36.0

SQUARE-MESH RELATIONSHIP

For a plain square weave: clear opening $a \approx 25.4/N - dw$ (mm), where N is mesh count per inch and dw is wire diameter in mm. Mesh count alone does not define the opening.

7.3 Wedge-Wire Reference

Slot Opening (in)	Approx. Opening (μm)	Open Area (%)
0.003	75	7.7
0.005	127	14.3
0.010	254	25
0.015	381	25
0.020	500	25
0.031	775	34
0.034	864	20
0.062	1550	51
0.063	1600	50
0.094	2350	44
0.125	3175	66
0.156	3962	71

7.4 Typical Element Materials

Material	Perforated	Mesh	Wedge Wire	Typical Application
Carbon steel	Yes	Yes	Possible	General non-corrosive service
Galvanized steel	Yes	Yes	Limited	Water / utility
SS304 / 304L	Yes	Yes	Yes	General corrosion-resistant
SS316 / 316L	Yes	Yes	Yes	Chemical / water / moderately chloride-bearing
Duplex stainless	Yes	Yes	Yes	Chloride / offshore / seawater
Super duplex	Yes	Yes	Yes	Severe chloride / seawater
Monel	Yes	Yes	Possible	Selected marine / chemical
Nickel alloys / Hastelloy	Yes	Yes	Possible	Severe corrosive chemical
Titanium	Yes	Yes	Possible	Selected severe corrosion environments

SPECIFICATION RULE

Do not specify only '100 mesh' or '3 mm perforation'. State opening, wire/plate geometry, open area, material, support construction, sealing and required differential-pressure capability.

PART III

SIZING AND HYDRAULICS

Open area, sizing, pressure drop, differential pressure, dirt-holding capacity and pump-suction service.

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8 OPEN AREA AND OPEN AREA RATIO

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Open area is a property of screen material; OAR compares the effective element area with pipe flow area.

Open area is the fraction of the straining material that is physically open to flow. Open area ratio (OAR) compares the effective open flow area of the complete element with the internal flow area of the pipe.

DEFINITIONS

Open Area (%) = $\text{area of openings} / \text{gross screen area} \times 100$. OAR = $\text{effective element open flow area} / \text{pipe internal flow area}$.

At 100% OAR, the clean element has only the same open flow area as the pipe. Any debris accumulation then makes the element a controlling restriction. Practical designs therefore require a loading margin selected for the actual solids duty, allowable pressure drop and cleaning interval.

Some historical general-service guidance has used approximately 250% OAR as a preliminary benchmark. It should not be treated as a universal acceptance rule; higher loading, finer openings and viscous fluids can require substantially more area.

8.1 Elements in Series

Convention	Method	Example
Line-of-sight	Multiply open fractions	50% plate $\times$ 30% mesh = 15%
Most-restrictive	Use smaller individual open area	50% plate + 30% mesh $\rightarrow$ 30% basis

COMPARISON RULE

State the OAR calculation convention in the enquiry. OAR values calculated by different conventions are not directly comparable.

9 STRAINER SIZING AND SELECTION DATA

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Sizing is a process-data exercise, not a pipe-size lookup.

Group	Required Input	Why It Governs
Piping	Line size and schedule	Pipe flow area, velocity and connection geometry
Piping	End connection and rating	Piping-class interface
Process	Fluid description / composition	Phase, compatibility and corrosion
Process	Min / normal / max flow	Hydraulic sizing range
Process	Operating / design P-T	Pressure boundary and material selection
Hydraulics	Allowable clean ΔP	Initial hydraulic limit
Hydraulics	Allowable loaded ΔP / cleaning trigger	Operating limit before cleaning
Element	Required retention / opening	Protected-equipment requirement

Group	Required Input	Why It Governs
Solids	Particle size, shape and loading	Retention, dirt capacity and cleaning interval
Operation	Can process stop for cleaning?	Single / duplex / automatic strategy
Layout	Orientation and removal clearance	Debris collection and maintainability
Special	NDE, code, client and documentation requirements	Procurement and acceptance

1. Define process and maximum required flow.
2. Define contamination and downstream-equipment sensitivity.
3. Select the coarsest opening that provides required protection.
4. Select element medium and support.
5. Select a candidate strainer type.
6. Calculate / compare effective open area.
7. Check clean and loaded pressure drop at maximum required flow.
8. Verify body rating and element differential-pressure strength.
9. Confirm maintenance interval, isolation, access and lifting clearance.
10. Verify against manufacturer certified data and project requirements.

10 PRESSURE DROP AND SCREEN LOADING

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The loaded condition is normally more important than the clean condition.

Pressure loss through a strainer results from body geometry, changes in direction, entry and exit losses, element restriction, fluid properties and the accumulated debris.

For turbulent incompressible flow through a fixed geometry, pressure loss varies approximately with velocity squared. This is useful for scaling and sanity checks, but it does not replace manufacturer hydraulic data and does not directly apply to laminar viscous flow.

LOADING SEQUENCE

Solids loading increases → effective open area decreases → velocity through remaining openings increases → differential pressure rises.

10.1 Three Differential-Pressure Conditions

Condition	Definition	Purpose
Clean ΔP	Differential pressure with the element clean	Initial hydraulic design condition
Loaded operating ΔP	Differential pressure at the intended cleaning condition	Operating / maintenance limit
Element structural ΔP limit	Maximum differential the element can withstand safely	Mechanical integrity requirement

DO NOT COMBINE THESE VALUES

A low clean pressure drop does not demonstrate adequate loaded performance, and the body pressure rating does not demonstrate element collapse strength.

11 ELEMENT STRENGTH AND DIFFERENTIAL PRESSURE

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The straining element is a structural component and must be checked independently.

When the element becomes blocked, pressure on the upstream side may be much higher than on the downstream side. The resulting differential pressure can deform, buckle, tear or collapse the element.

- Element material and thickness.
- Perforation / mesh / slot geometry.
- Element diameter and unsupported span.
- Support cage and reinforcing ribs.
- Seam and weld design, including fatigue from repeated loading and cleaning.
- Direction of pressure loading.

FAILURE CONSEQUENCE

A collapsed element can release the entire accumulated debris load downstream in a single event. Element differential-pressure capability must therefore be verified independently of the body pressure rating.

12 DIRT-HOLDING CAPACITY AND CLEANING INTERVAL

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Particle size sets retention; solids loading sets capacity and cleaning frequency.

Dirt-holding capacity is the amount of retained solid material that can accumulate before cleaning is required. It is influenced by screen area, basket volume, collection chamber volume, particle geometry, solids concentration, element opening, flow velocity and the allowable loaded differential pressure.

Duty	Typical Strategy	Reason
Low loading / coarse debris	Y or compact simplex may be adequate	Cleaning interval can be relatively long
Moderate/high liquid solids	Basket / high-capacity body	Larger area and collection volume
Continuous process	Duplex	Cleaning without process shutdown
High / unpredictable loading	Automatic self-cleaning	Cleaning frequency controlled automatically
Fine retention + high loading	Staged coarse + fine arrangement	Protect final fine element from rapid blockage

ROOT-CAUSE RULE

If cleaning frequency suddenly increases, investigate the upstream source of solids. Repeatedly cleaning the strainer treats the symptom, not the changed contamination condition.

13 PUMP SUCTION STRAINERS

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Suction-side pressure loss directly reduces available NPSH margin.

A pump-suction strainer must be evaluated differently from a discharge-side restriction because its pressure loss reduces the pressure available at the pump inlet.

- Check maximum operating flow, not only normal flow.

- Use the loaded strainer pressure drop, not only the clean value.
- Compare against available NPSH margin and the pump manufacturer's requirements.
- Consider fluid vapour pressure and minimum suction conditions.
- Establish a cleaning trigger that protects both hydraulic performance and element strength.

CRITICAL RULE

A suction strainer that satisfies the NPSH check when clean can become unacceptable after debris accumulates. Evaluate the expected loaded condition at maximum required flow.

PART IV

INSTALLATION, OPERATION AND MAINTENANCE

Orientation, drainage, monitoring, cleaning and temporary-service practice.

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14 INSTALLATION, ORIENTATION AND MAINTENANCE ACCESS CONTENTS

Correct selection can still fail if orientation or maintenance clearance is wrong.

Item	Requirement	Engineering Reason
Flow direction	Install to manufacturer's flow arrow	Incorrect direction can load the element against unsupported geometry
Y strainer	Orient pocket to retain debris and permit drainage	Pocket position depends on fluid phase and piping orientation
Basket strainer	Normally horizontal piping with cover accessible above	Provide vertical basket-removal clearance
Vertical downward flow	Y / suitable tee configuration may be used	Keep collection pocket at effective low point
Support	Do not impose excessive piping loads	Large strainers may require independent support
Maintenance space	Allow screen/basket withdrawal and lifting	Access is a design requirement
Isolation	Provide valves where required	Safe cleaning and maintenance
Drain / vent	Locate for complete draining / venting	Avoid trapped pressure or retained liquid

15 DRAIN, BLOWDOWN, VENTING AND DIFFERENTIAL-PRESSURE MONITORING CONTENTS

These connections are functional parts of the operating philosophy.

A drain removes retained fluid from an isolated strainer. A blowdown connection is intended to discharge accumulated debris, potentially while the system remains pressurised. A vent releases trapped air or gas during filling, draining or maintenance.

The blowdown connection must be large enough and arranged so that the expected debris can actually pass. A connection that is adequate only for liquid drainage may be ineffective for solids removal.

15.1 Differential-Pressure Monitoring

- Separate upstream and downstream pressure gauges.
- Direct-reading differential-pressure gauge.
- Differential-pressure switch for alarm or cleaning initiation.
- Differential-pressure transmitter for control-system monitoring.

CONDITION MONITORING

Rising ΔP indicates loss of effective flow area. The cleaning trigger should be based on hydraulic limits and element strength, not on an arbitrary universal value.

16 CLEANING, MAINTENANCE AND AUTOMATIC SELF-CLEANING SYSTEMS

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The cleaning philosophy should be selected with the strainer, not after installation.

16.1 Manual Cleaning Sequence

1. Isolate the strainer from the process.
2. Depressurise and verify zero pressure.
3. Drain or safely remove retained fluid.
4. Open the cover using the specified procedure.
5. Remove the element and clean without damaging openings or support.
6. Inspect for deformation, corrosion, erosion, torn mesh, damaged welds and bypass paths.
7. Replace damaged gaskets/seals as required.
8. Reinstall, tighten in the specified sequence and return to service.
9. Record condition, debris type and cleaning interval.

16.2 Automatic Self-Cleaning

Automatic strainers complete a cleaning cycle with little routine manual intervention. Controls may initiate cleaning from differential pressure, time, operator command or a combination of conditions.

Control Mode	Operation	Use
Differential-pressure trigger	Cleaning starts when loading reaches the established ΔP	Best match to actual fouling condition
Timer	Cleaning occurs at preset interval	Useful where loading is relatively predictable
Manual pushbutton	Operator initiates cycle	Semi-automatic operation
Continuous cleaning	Cleaning mechanism operates continuously	Suitable where solids loading is persistent and mechanism allows

AUTOMATIC DOES NOT MEAN MAINTENANCE-FREE

Automatic cleaning shifts the maintenance task from basket removal to the cleaning mechanism, controls, blowdown route and waste-disposal system.

17 TEMPORARY AND COMMISSIONING STRAINERS

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Temporary strainers are used for finite construction debris; they require a defined removal decision.

Temporary cone, truncated-cone and flat strainers are commonly used during flushing, commissioning and initial start-up to intercept weld slag, mill scale, rust, grinding particles and other construction debris.

- Record the temporary strainer location on commissioning documentation.
- Define the removal criterion before start-up.
- Monitor differential pressure during commissioning.
- Verify structural strength for the maximum credible differential pressure.

Do not leave a temporary strainer permanently in service by default.

IF RETAINED PERMANENTLY

If a temporary strainer is intentionally retained after commissioning, evaluate it as a permanent restriction with documented pressure-drop, strength, material, inspection and maintenance requirements.

PART V

QUALITY, PROCUREMENT AND TROUBLESHOOTING

Inspection, testing, specification, failure analysis and final selection checks.

IN THIS PART

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| 18 | Inspection, Testing and Transient Conditions |
| 19 | Specification and Procurement |
| 20 | Troubleshooting and Common Selection Errors |
| 21 | Final Engineering Selection Checklist |

18 INSPECTION, TESTING AND TRANSIENT CONDITIONS

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Inspection and testing must be defined by the governing code, project specification and risk level.

Inspection / Test	Purpose	Typical Scope
Material certification	Verify specified product form and grade	Pressure boundary and element materials
PMI	Confirm alloy identity where required	Stainless, duplex and nickel-alloy service
Visual / dimensional	Check fabrication, dimensions and assembly	All equipment
Liquid penetrant	Surface-breaking defects in nonmagnetic materials	Welds/castings where specified
Magnetic particle	Surface / near-surface defects in ferromagnetic materials	Carbon/alloy steel where specified
Radiography / UT	Internal weld or casting integrity	Project / code requirement
Hydrostatic pressure test	Pressure-boundary integrity	Normally required by applicable design basis
Pneumatic / leak test	Leak tightness where justified	Requires specific safety controls
Element inspection	Opening, mesh count, support, welds and fit	All strainers

18.1 Hydraulic and Thermal Transients

Rapid changes in fluid velocity can generate hydraulic shock. Rapid temperature changes can generate thermal stress. Both can impose loads significantly different from steady-state operating conditions.

Where credible transients exist, the strainer body, cover joint, end connections, supports and element should be evaluated against the applicable transient design basis.

TRANSIENT CAUTION

Do not assume that a system with modest steady operating pressure cannot produce severe transient loading. Water hammer, trapped condensate slugs and rapid temperature changes must be considered where applicable.

19 SPECIFICATION AND PROCUREMENT

[CONTENTS](#)

A good enquiry allows suppliers to make technically comparable selections.

Data Group	Minimum Information
Identification	Tag number, quantity, service
Piping	Line size, schedule, end connection, flange class
Process	Fluid, min/normal/max flow, density, viscosity
Pressure / temperature	Operating, design and minimum temperature
Contamination	Particle size, solids concentration, character
Retention	Required opening / particle protection basis
Element	Perforation / mesh / wedge wire, material, support

Data Group	Minimum Information
Hydraulics	Allowable clean ΔP and loaded ΔP
Mechanical	Body material, element material, gasket, bolting
Operation	Single/duplex/automatic, cleaning philosophy
Connections	Drain, blowdown, vent, DP tapping
Layout	Orientation, removal clearance, lifting requirement
Quality	Design code, NDE, testing, coating, documentation
Automatic controls	Power supply, enclosure, control method, instrumentation

PROCUREMENT PRINCIPLE

Do not compare quotations only on line size and screen opening. Compare effective screen area, pressure-loss basis, element differential-pressure limit, materials, cleaning arrangement, maintenance access, testing and documentation.

20 TROUBLESHOOTING AND COMMON SELECTION ERRORS

[^ CONTENTS](#)

Recurring field problems usually trace back to retention, hydraulics, strength, installation or maintenance.

Symptom	Probable Cause	Engineering Check
High ΔP immediately after start-up	Undersized body, too-fine element, incorrect flow/orientation	Verify sizing, element and installation
ΔP rises very rapidly	Higher-than-expected solids loading or blinding debris	Inspect debris source and element type
Element repeatedly deforms/collapses	Insufficient element ΔP strength or support	Review maximum credible differential and support design
Debris appears downstream	Element damage, bypass, seal failure or opening too large	Inspect element, seat and sealing
Pump cavitation	Excess suction-side loaded ΔP	Check NPSH at maximum flow and loaded condition
Cleaning too frequent	Low element area, excessive fineness, high loading	Review OAR, opening and body size
Screen erosion	High local velocity or abrasive solids	Increase area / upgrade material / change element
Cover leakage	Gasket, bolting, seating or assembly issue	Inspect joint and tightening procedure
Automatic cleaning ineffective	Wrong mechanism, controls or blowdown route	Review solids character and cleaning system

20.1 Common Selection Errors

Error	Consequence
Selecting from pipe size alone	Arbitrary screen area and cleaning interval
Choosing the finest available screen	Rapid blockage and unnecessary pressure loss
Ignoring solids loading	Cleaning frequency becomes unsustainable
Checking only clean ΔP	Loaded condition may starve the process
Ignoring element collapse strength	Potential debris release downstream
Treating flange class as complete strainer rating	Pressure-boundary error
Ignoring maintenance clearance	Element cannot be removed safely
Using clean suction ΔP in NPSH check	Delayed cavitation after loading
Leaving temporary strainer indefinitely	Uncontrolled permanent restriction
Specifying only mesh count	Retention and open area remain undefined

21 FINAL ENGINEERING SELECTION CHECKLIST

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A concise approval checklist for engineering, procurement and technical bid review.

Area	Verify Before Approval
Process	Fluid; min/normal/max flow; density; viscosity; operating/design P-T
Contamination	Particle size; loading; shape; abrasiveness; fibrous/adherent character
Protection	Protected equipment and smallest harmful particle / passage
Element	Opening; medium; material; open area; support; sealing; allowable ΔP
Hydraulics	Clean ΔP ; loaded ΔP ; OAR basis; maximum flow
Mechanical	Body rating; materials; corrosion allowance; end connections; gasket; bolting
Operation	Can process stop? cleaning method; interval; DP monitoring; blowdown
Layout	Orientation; removal clearance; lifting; support; isolation; access
Quality	Code; MTC; NDE; pressure test; inspection; documentation
Final verification	Manufacturer certified hydraulic, dimensional and pressure-temperature data

FINAL APPROVAL RULE

A strainer is not fully selected until retention, hydraulics, element strength, pressure-temperature capability, materials, process continuity and maintainability are all acceptable together.

21.1 Final Approval Output

Approval Item	Required Output
Selected strainer type	Y / basket / duplex / tee / temporary / automatic / wafer / special
Nominal size and end connection	Line interface and rating
Element	Medium, opening, material, support and sealing
Effective area	Open area and OAR calculation basis
Hydraulic performance	Clean ΔP and loaded ΔP at maximum required flow
Mechanical limit	Element allowable differential pressure and body P-T rating
Operation	Cleaning method, cleaning trigger, isolation and blowdown
Layout / maintenance	Orientation, withdrawal clearance, lifting and access
Documentation	GA, datasheet, MTC, QAP/ITP, test reports and certified performance data

The approval output above becomes the basis for the final datasheet, purchase specification and manufacturer technical review.

APPENDICES

REFERENCE TABLES AND QUICK REFERENCE

Compact data intended for engineering lookup during later book development.

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| A | Quick Selection Matrix |
| B | Element Specification Examples |
| C | Key Terms |

A QUICK SELECTION MATRIX

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Condition	First Type to Evaluate
High pressure / compact installation	Y strainer
Liquid service / significant solids	Basket strainer
Uninterrupted manual-cleaning duty	Duplex strainer
High / variable solids; manual cleaning impractical	Automatic self-cleaning
Commissioning / flushing	Temporary / conical
Short face-to-face	Wafer / plate
Fine reusable retention	Mesh-supported / micron configuration
Viscous / high-capacity service	High-capacity basket

B ELEMENT SPECIFICATION EXAMPLES

[CONTENTS](#)

PERFORATED PLATE EXAMPLE

SS316L perforated element; 3 mm round holes on 4.5 mm pitch, 60° staggered; approximately 40.3% open area; plate thickness and support to suit specified maximum differential pressure.

WIRE MESH EXAMPLE

SS316L plain square woven mesh; 100 mesh; 0.0045 in wire diameter; nominal clear opening approximately 141 µm; approximately 30% open area; supported on perforated SS316L plate; complete element to suit specified maximum differential pressure.

WEDGE-WIRE EXAMPLE

SS316L wedge-wire element; specified slot width and tolerance; supplier to state effective open area, support construction and allowable differential pressure.

C KEY TERMS

[CONTENTS](#)

Term	Definition
Strainer	Mechanical device that retains unwanted solids from a flowing fluid.
Straining element	Perforated plate, mesh, wedge wire or other element that performs separation.
Screen opening	Clear opening through which fluid and sufficiently small particles pass.
Mesh count	Number of openings per inch in a woven mesh; not the same as opening size.
Open area	Fraction of screen material that is open to flow.

Term	Definition
Open area ratio (OAR)	Effective element open flow area divided by pipe internal flow area.
Clean ΔP	Differential pressure across the strainer when clean.
Loaded ΔP	Differential pressure after debris accumulation.
Element ΔP limit	Maximum differential pressure the element can withstand safely.
Dirt-holding capacity	Quantity of solids that can accumulate before cleaning is required.
Drain	Connection for removing retained liquid, normally after isolation.
Blowdown	Connection intended to discharge accumulated debris.
Upstream / downstream	Approach side / discharge side of the strainer.



ENGINEERING SUMMARY

A pipeline strainer is effective only when retention, hydraulic performance, element strength, pressure-temperature capability, materials, process continuity and maintainability are considered as one engineering selection.

HYDROTHERMS