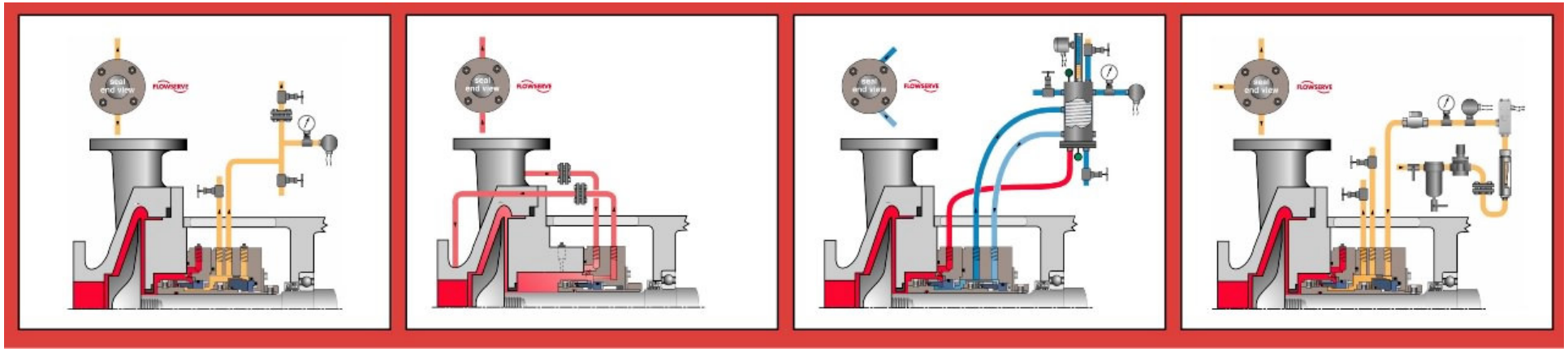
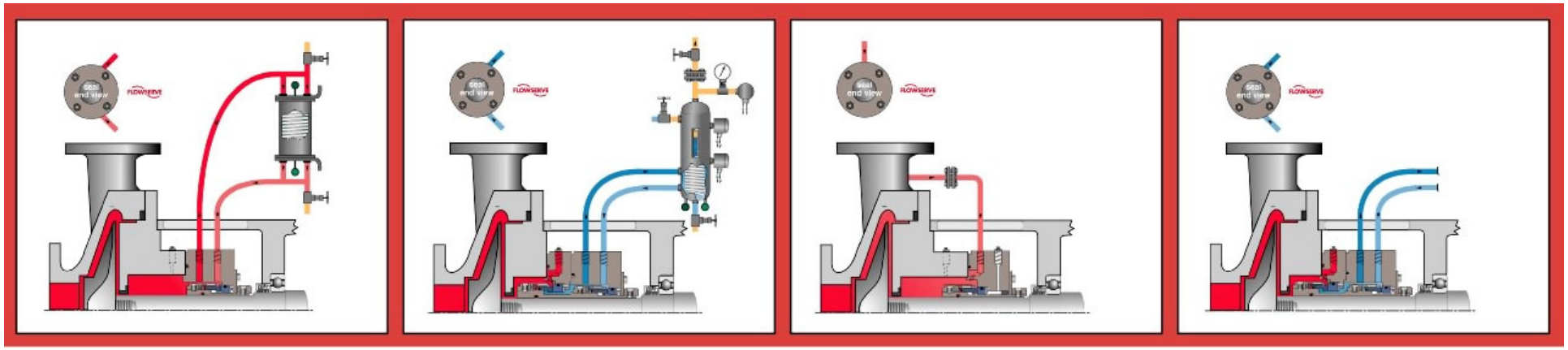


FLOWSERVE®

Piping Plans for Dual Mechanical Seals



Purpose of Piping Plans

- Create a more favorable environment for the mechanical seal
  - Flushing to remove heat
  - Lowering fluid temperature
  - Altering the seal chamber pressure
  - Cleaning the process fluids
  - Control atmospheric side of seal

Purpose of Piping Plans

- Provide a means of detecting and controlling seal leakage
  - Capture and/or prevent leakage
  - Detect leakage
  - Route leakage to appropriate collection or disposal system
  - Provide fluid other than process fluid for the seal environment

Requirements of Mechanical Seals

- Liquid seals
  - Stable fluids
  - Good lubricating properties
  - Fluids do not flash or vaporize in seal chamber
  - Free from contamination and solids
  - Moderate viscosities

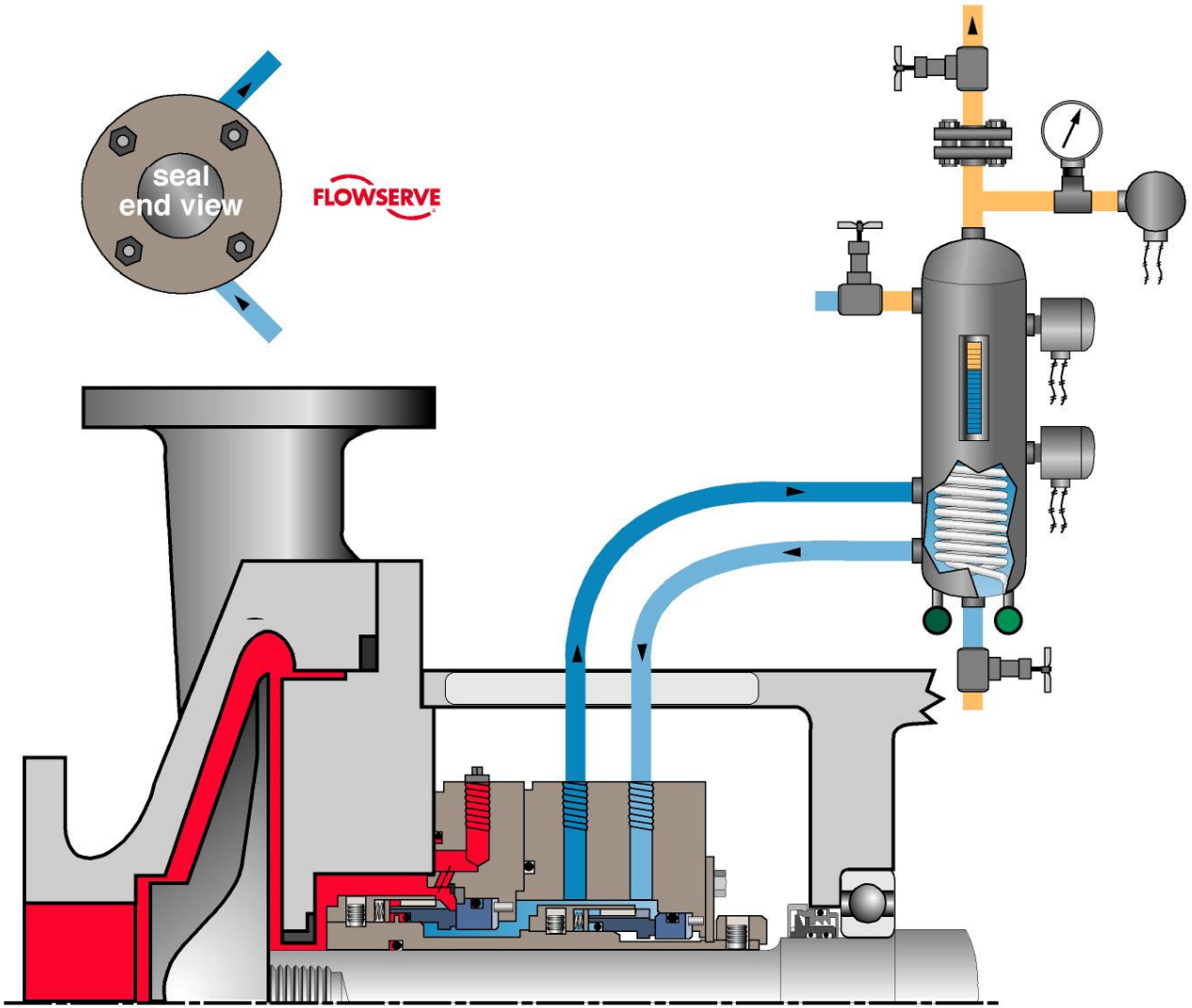
Requirements of Mechanical Seals

- Gas seals
  - Gas or vapor suitable for sealing
  - Constant supply of external buffer/barrier gas
  - Process fluids free from contamination from both liquids and solids
  - Process fluids which are not adversely affected by gas leakage

Methods of Achieving Goals

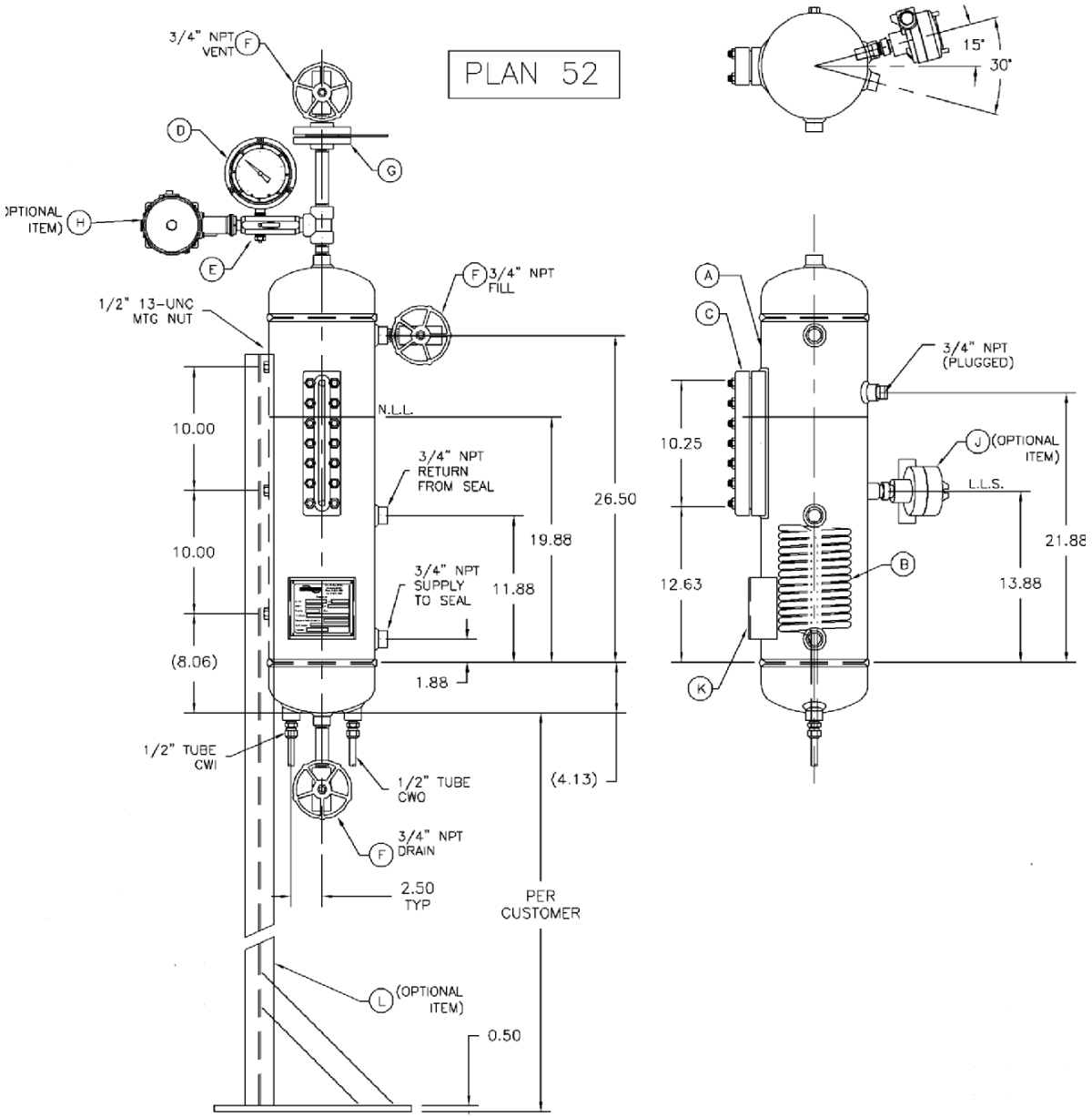
- Piping or routing of process fluids
- Introduction of external fluids
- Auxiliary equipment
  - Seal coolers
  - Cyclone separators
  - Reservoirs
- Instrumentation

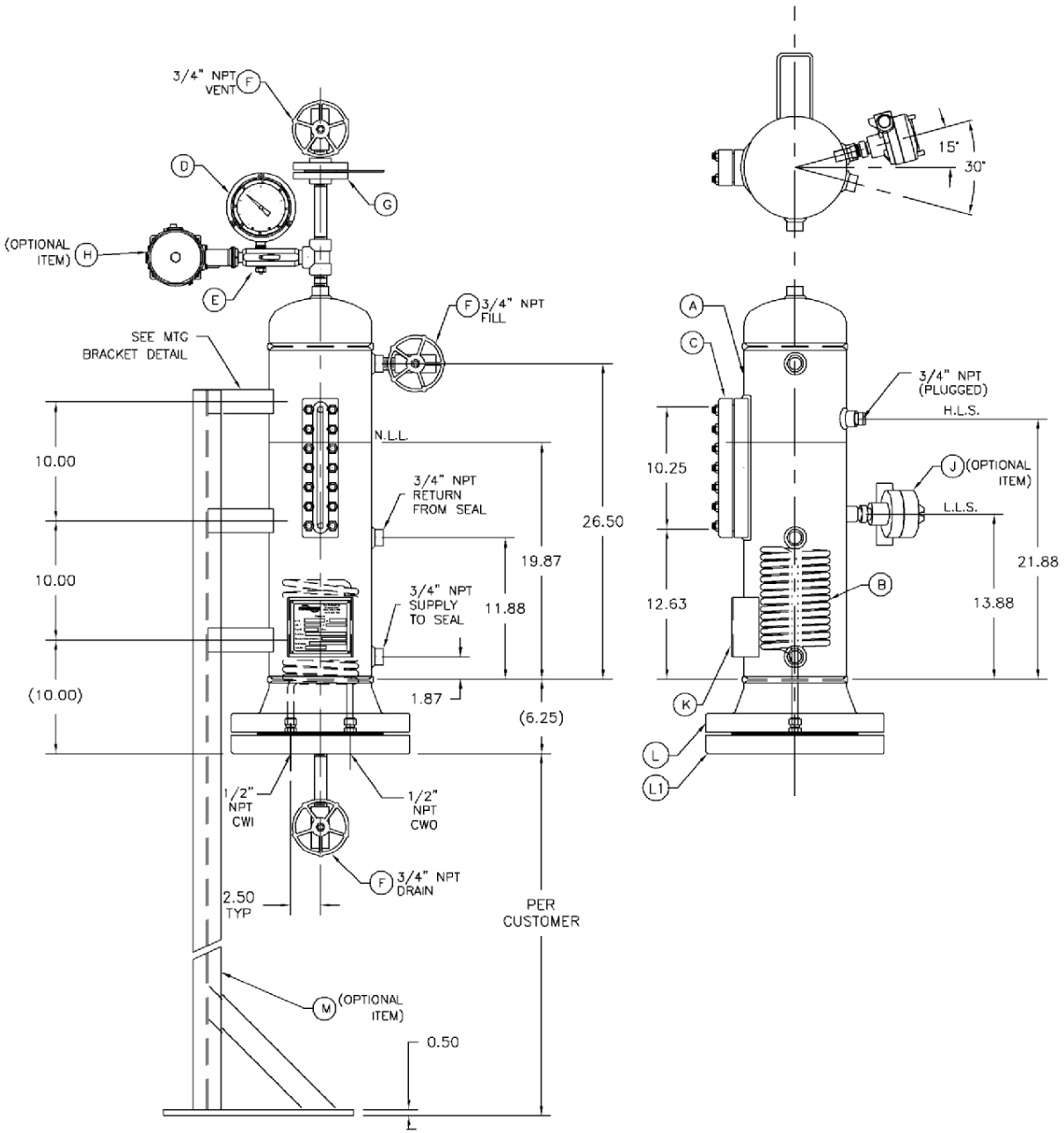
Plan 52



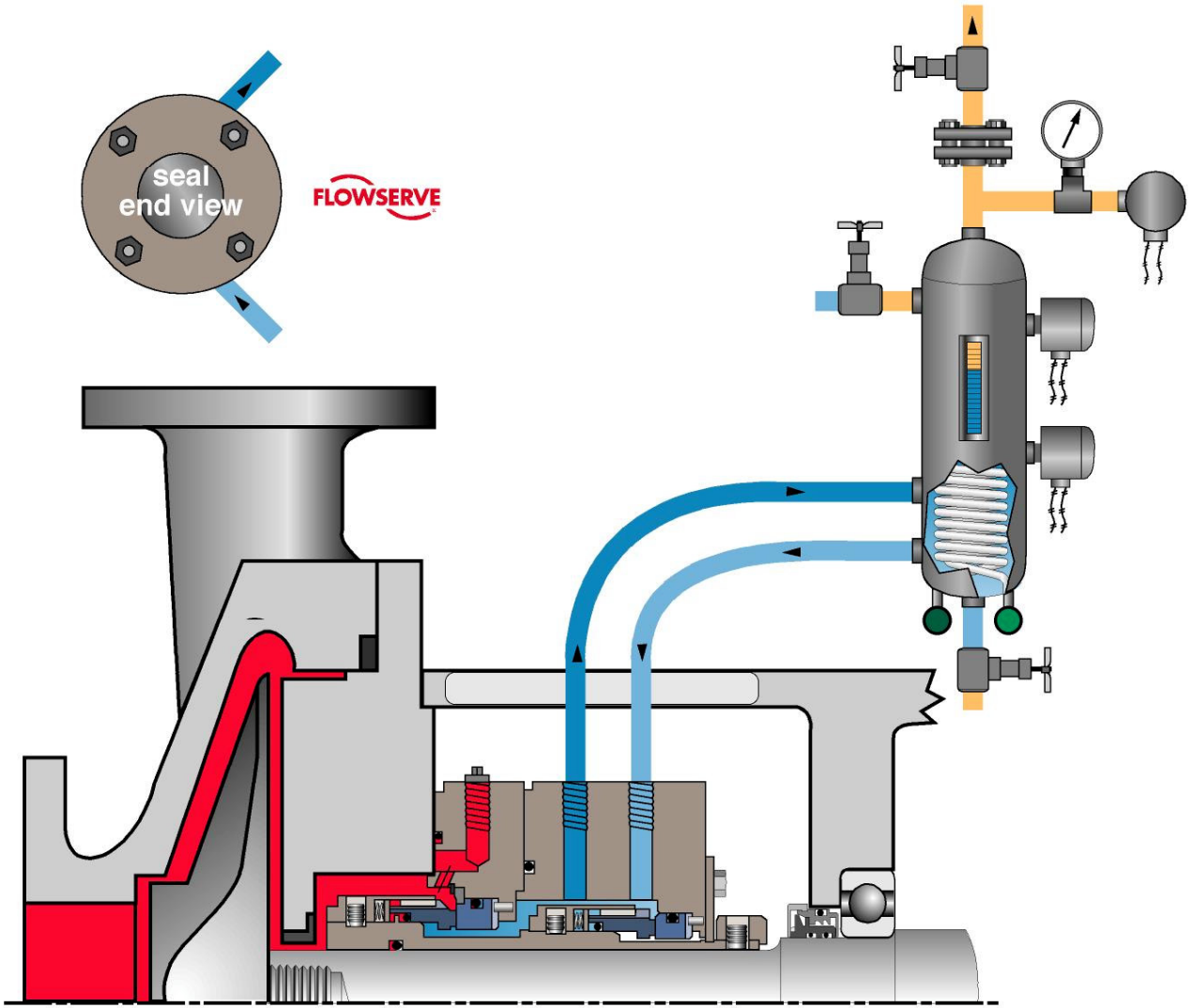
What

- Unpressurized buffer fluid circulation through reservoir.
- Fluid is circulated by a pumping ring in the dual seal assembly.


PLAN 52
3/4" NPT VENT
F
D
G
OPTIONAL ITEM
H
E
F 3/4" NPT FILL
1/2" 13-UNC MTG NUT
N.L.L.
10.00
3/4" NPT RETURN FROM SEAL
26.50
19.88
10.00
3/4" NPT SUPPLY TO SEAL
11.88
(8.06)
1.88
1/2" TUBE CWI
1/2" TUBE CWO
(4.13)
3/4" NPT DRAIN
F
2.50 TYP
PER CUSTOMER
L (OPTIONAL ITEM)
0.50
15°
30°
A
C
3/4" NPT (PLUGGED)
10.25
J (OPTIONAL ITEM)
L.L.S.
21.88
12.63
B
13.88
K


3/4" NPT VENT
F
D
G
(OPTIONAL ITEM)
H
E
F 3/4" NPT FILL
SEE MTG BRACKET DETAIL
N.L.L.
3/4" NPT RETURN FROM SEAL
3/4" NPT SUPPLY TO SEAL
10.00
10.00
(10.00)
26.50
19.87
11.88
1.87
(6.25)
1/2" NPT CWI
1/2" NPT CWO
F 3/4" NPT DRAIN
2.50 TYP
PER CUSTOMER
M (OPTIONAL ITEM)
0.50
15°
30°
A
C
3/4" NPT (PLUGGED)
H.L.S.
J (OPTIONAL ITEM)
L.L.S.
10.25
12.63
21.88
13.88
B
K
L
L1

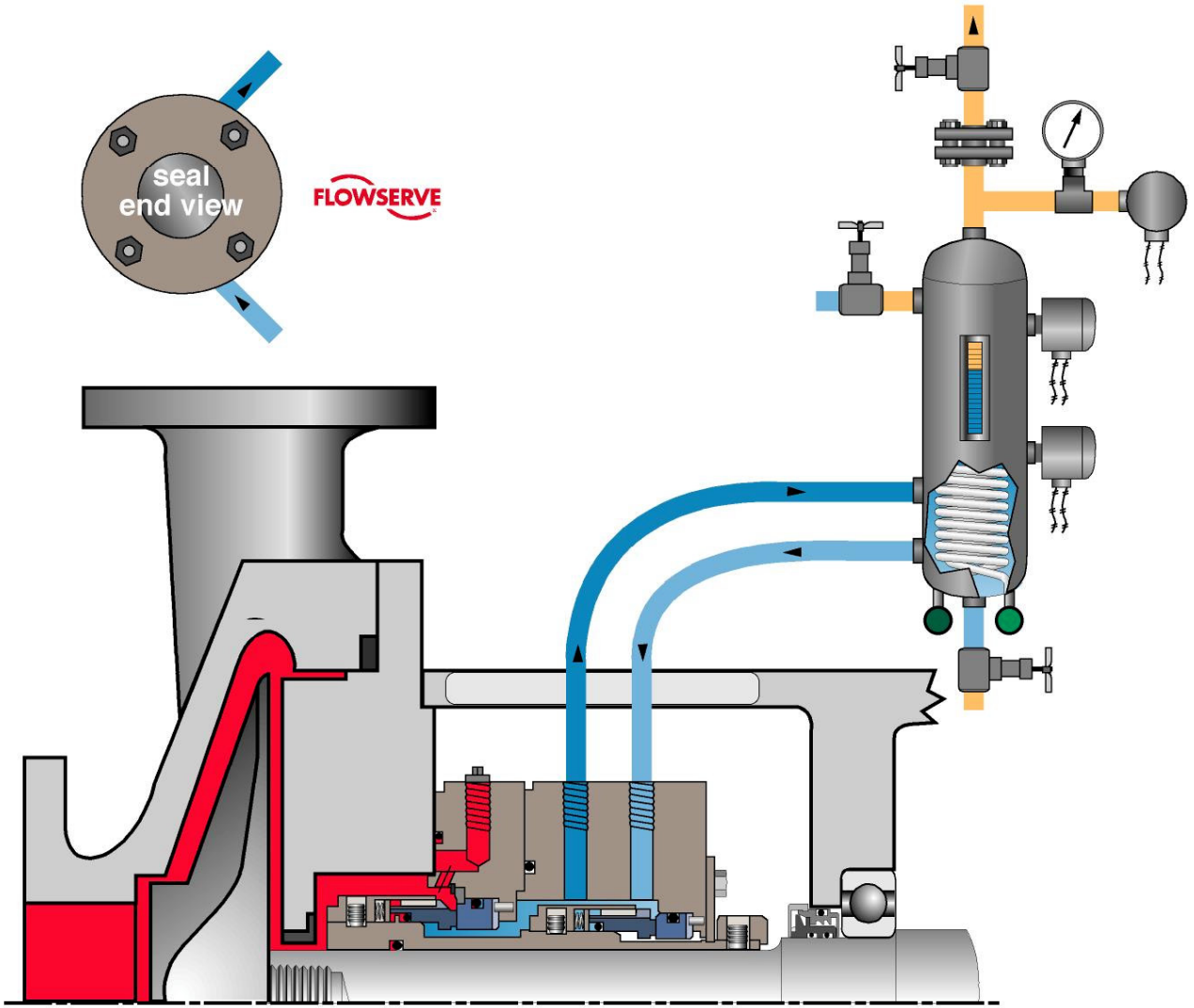
Plan 52



Why

- Outboard seal acts as a safety backup to the primary seal.
- Zero to very low process emissions.
- No process contamination is allowed.

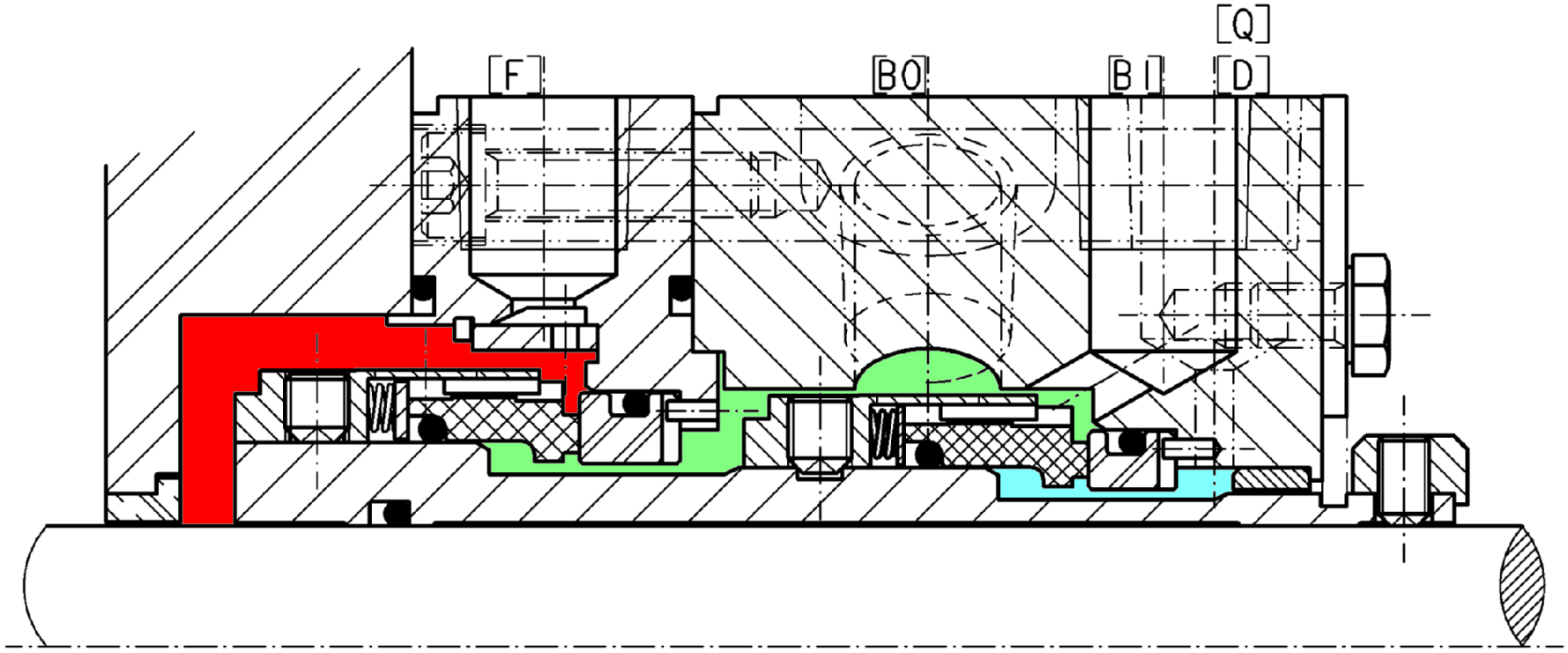
Plan 52



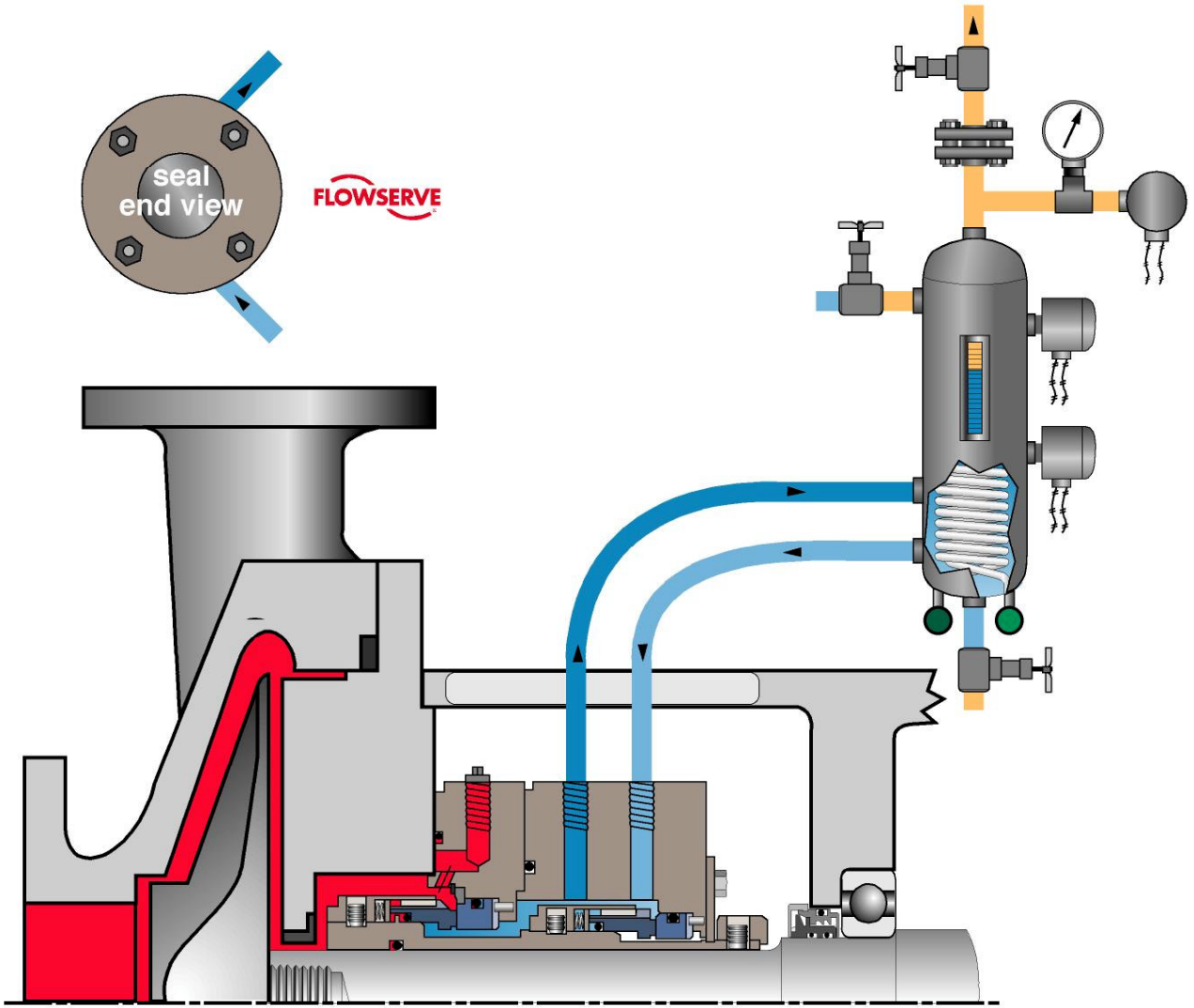
Where

- Used with dual unpressurized seals (“tandem”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Heat transfer fluids.

API 682 Type A Arrangement 2
2CW-CW



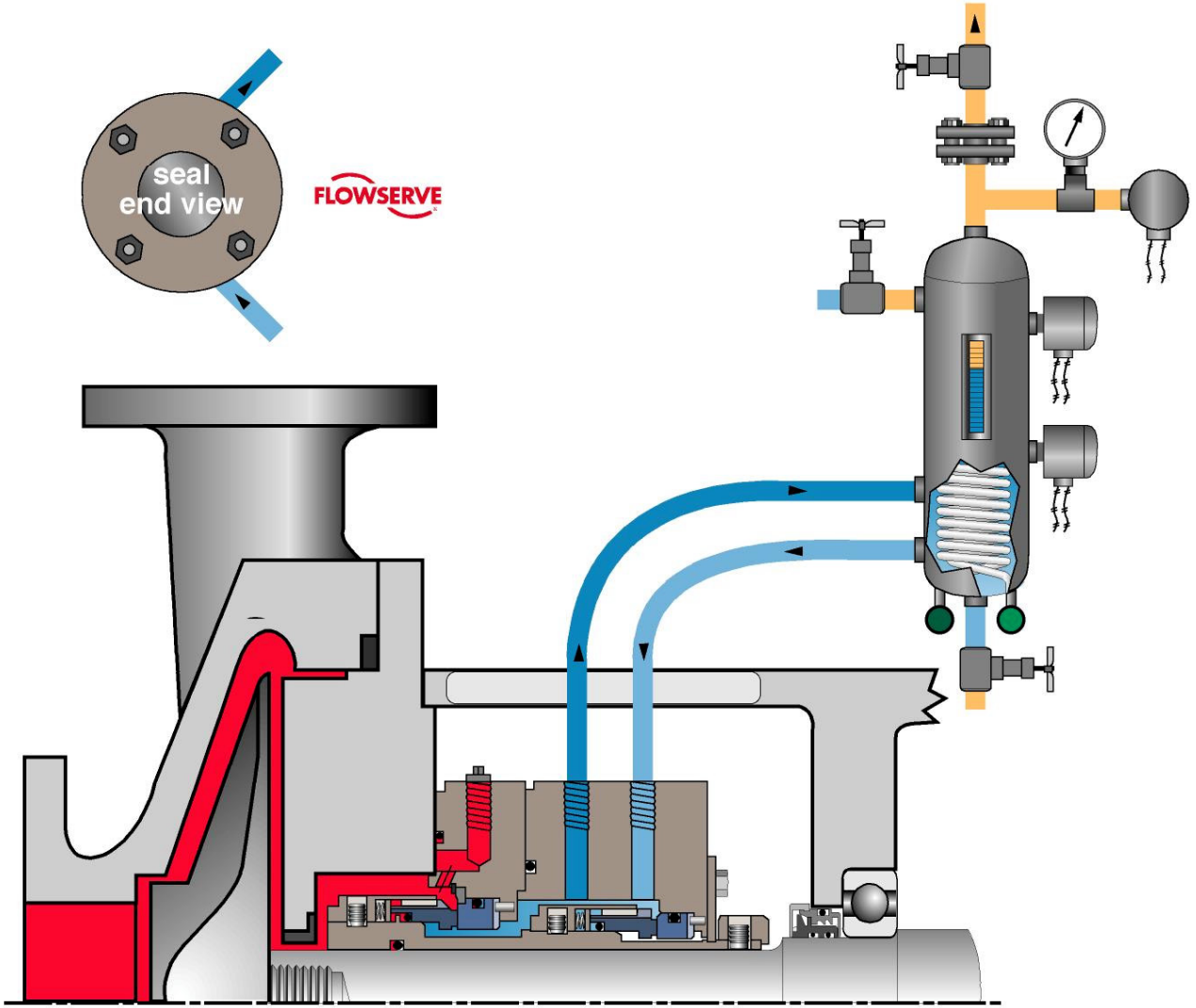
Plan 52



Preventative Maintenance

- Piping loop must self-vent to vapor recovery/flare system near atmospheric pressure.
- Process vapor pressure is generally greater than reservoir pressure.
- Buffer fluid must be compatible with process leakage.

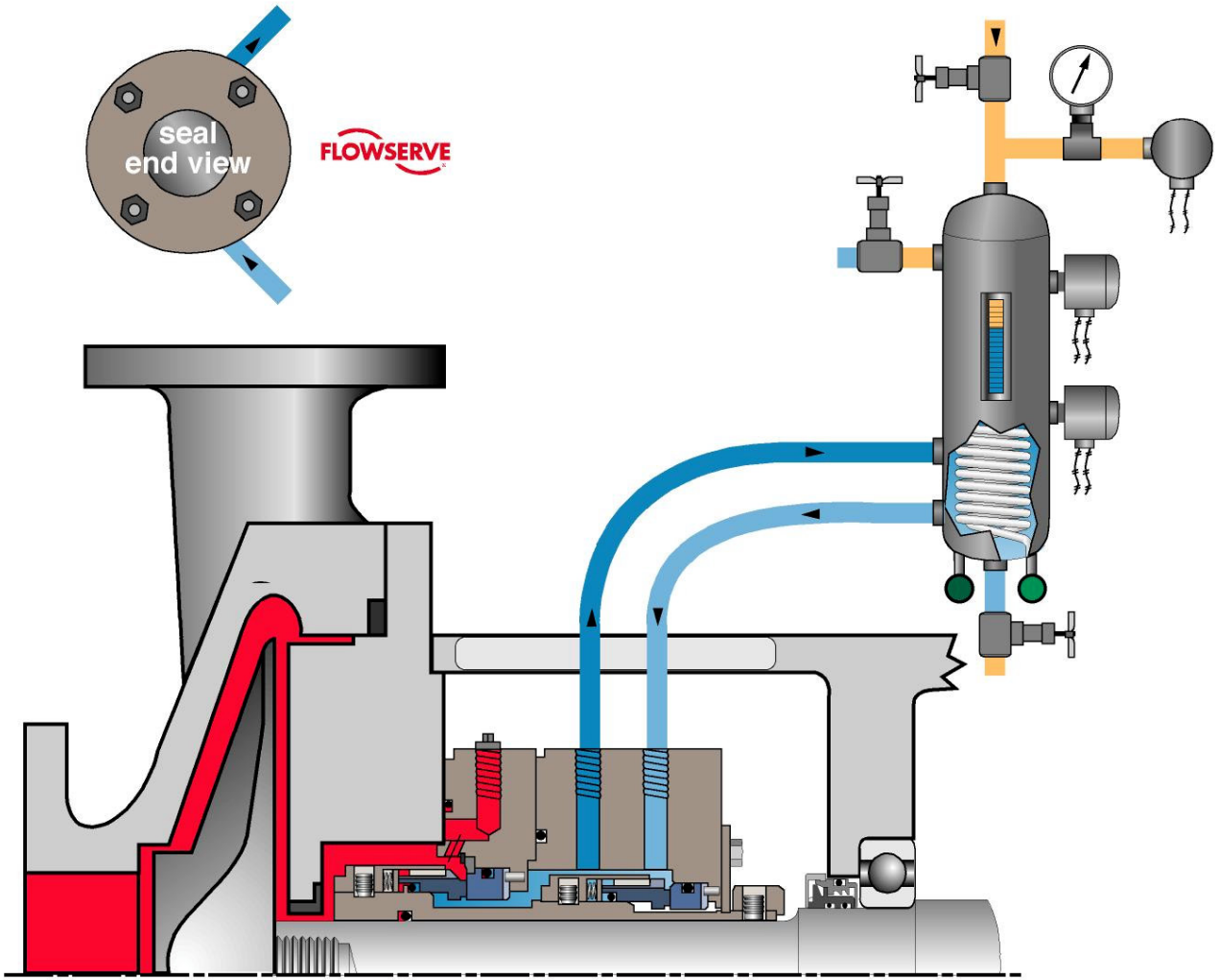
Plan 52



Preventative Maintenance (continued)

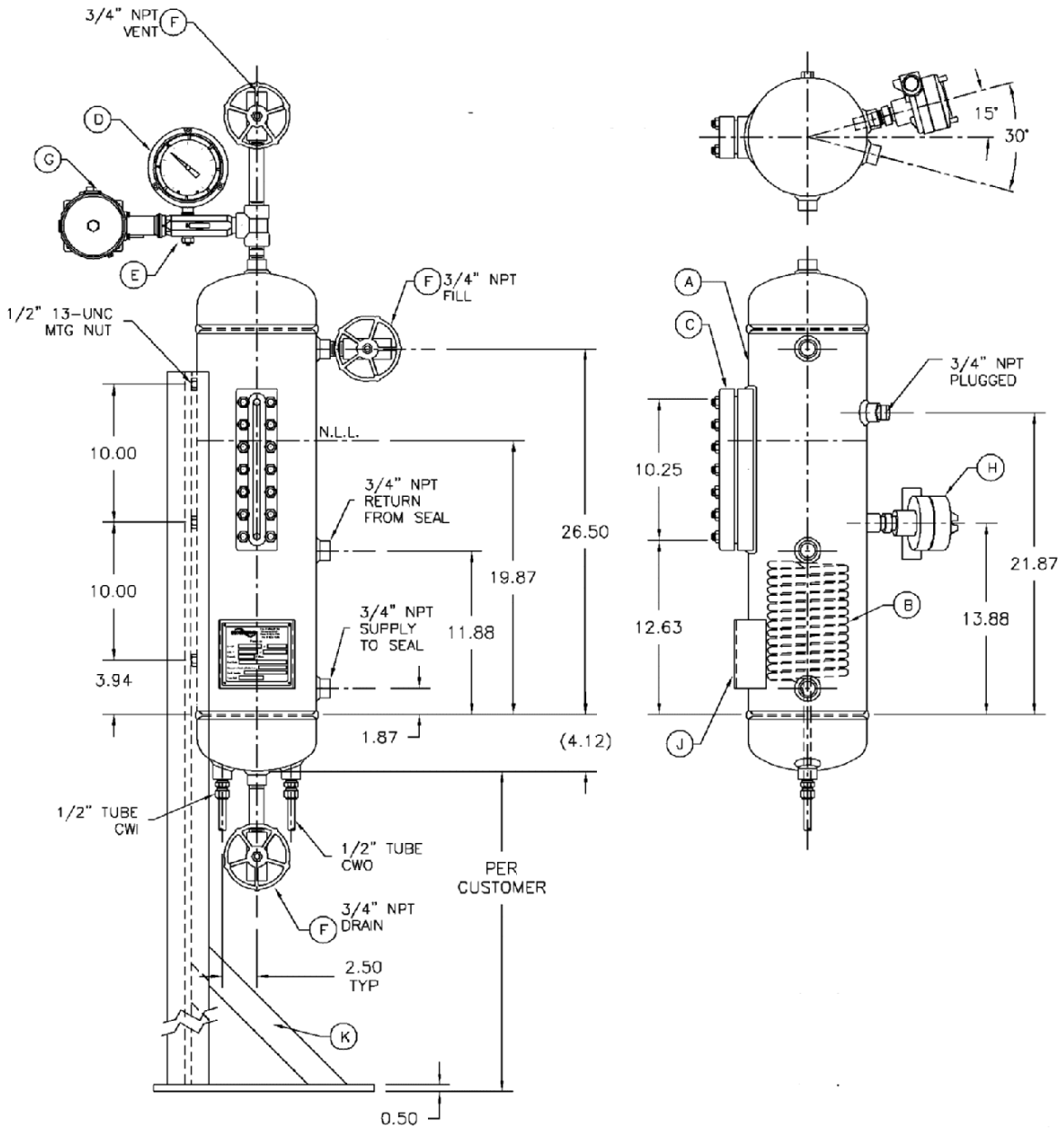
- Primary seal leakage is indicated by increased vent pressure.
- Reservoir level gage indicates outboard seal leakage.

Plan 53A

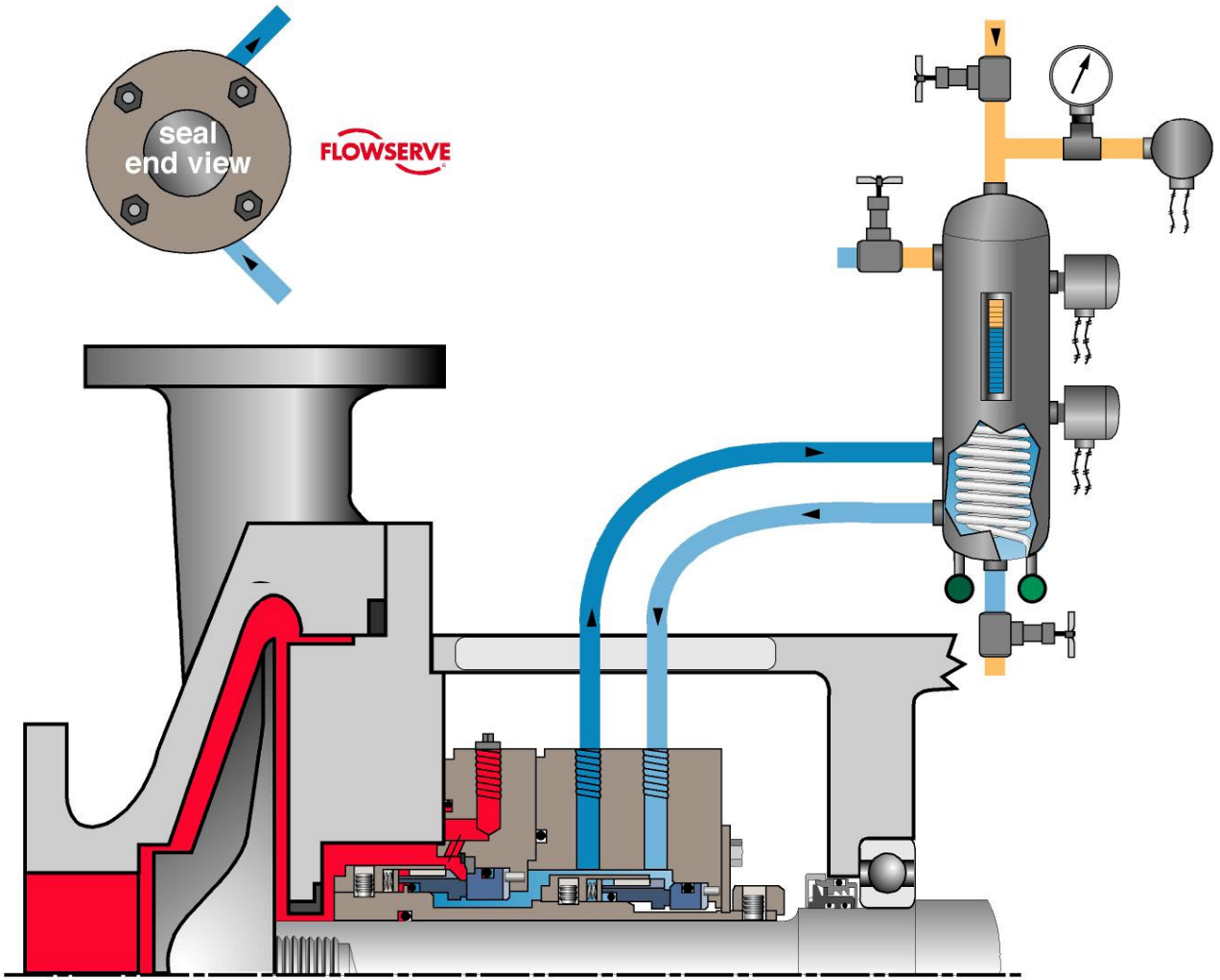


What

- Pressurized barrier fluid circulation through reservoir.
- Fluid is circulated by a pumping ring in the dual seal assembly.


3/4" NPT VENT
F
D
G
E
F 3/4" NPT FILL
1/2" 13-UNC MTG NUT
N.L.L.
10.00
10.00
3.94
3/4" NPT RETURN FROM SEAL
3/4" NPT SUPPLY TO SEAL
19.87
11.88
26.50
1.87
(4.12)
1/2" TUBE CWI
1/2" TUBE CWO
PER CUSTOMER
F 3/4" NPT DRAIN
2.50 TYP
K
0.50
15°
30°
A
C
3/4" NPT PLUGGED
10.25
12.63
H
B
J
21.87
13.88

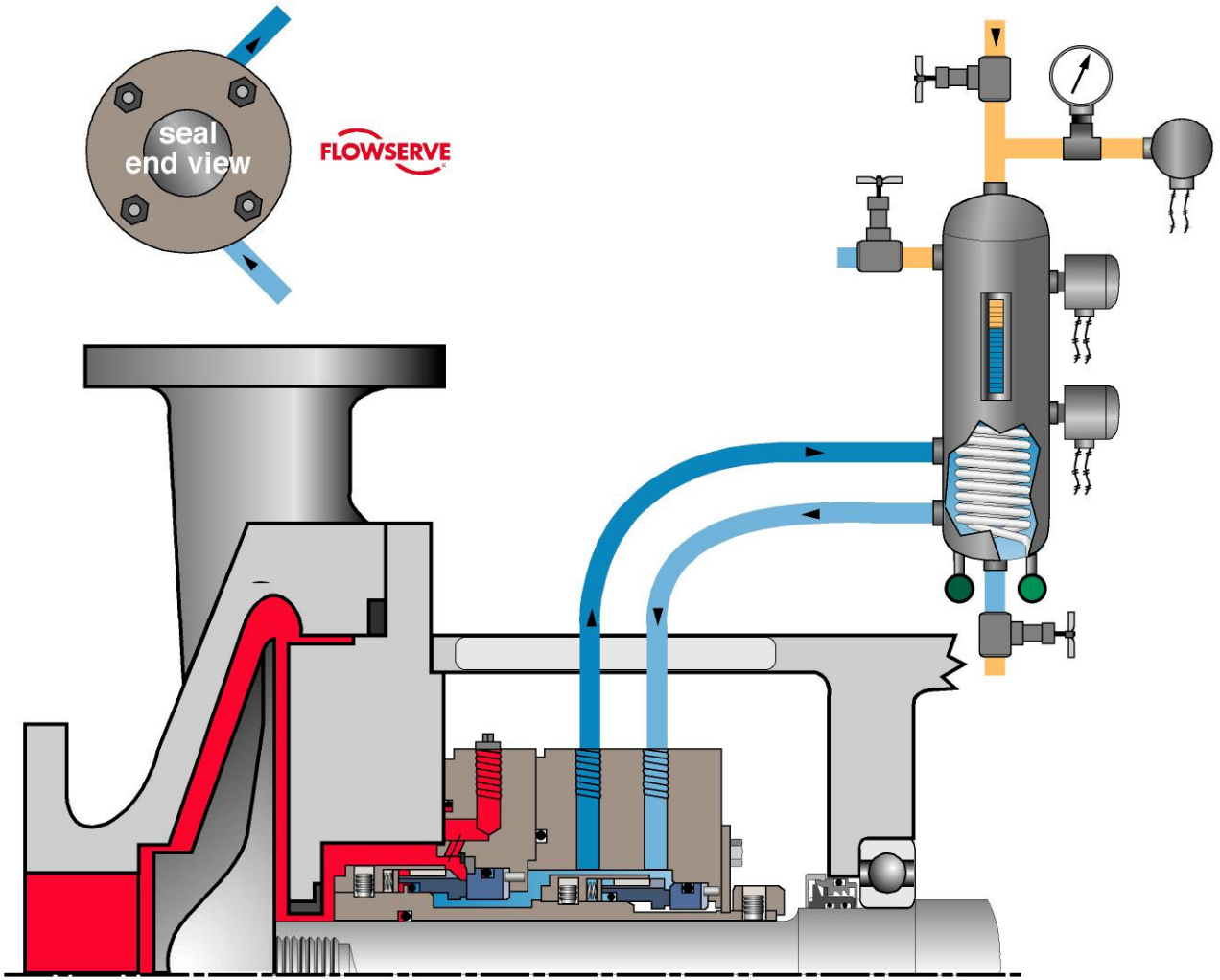
Plan 53A



Why

- Isolate process fluids.
- Zero process emissions.

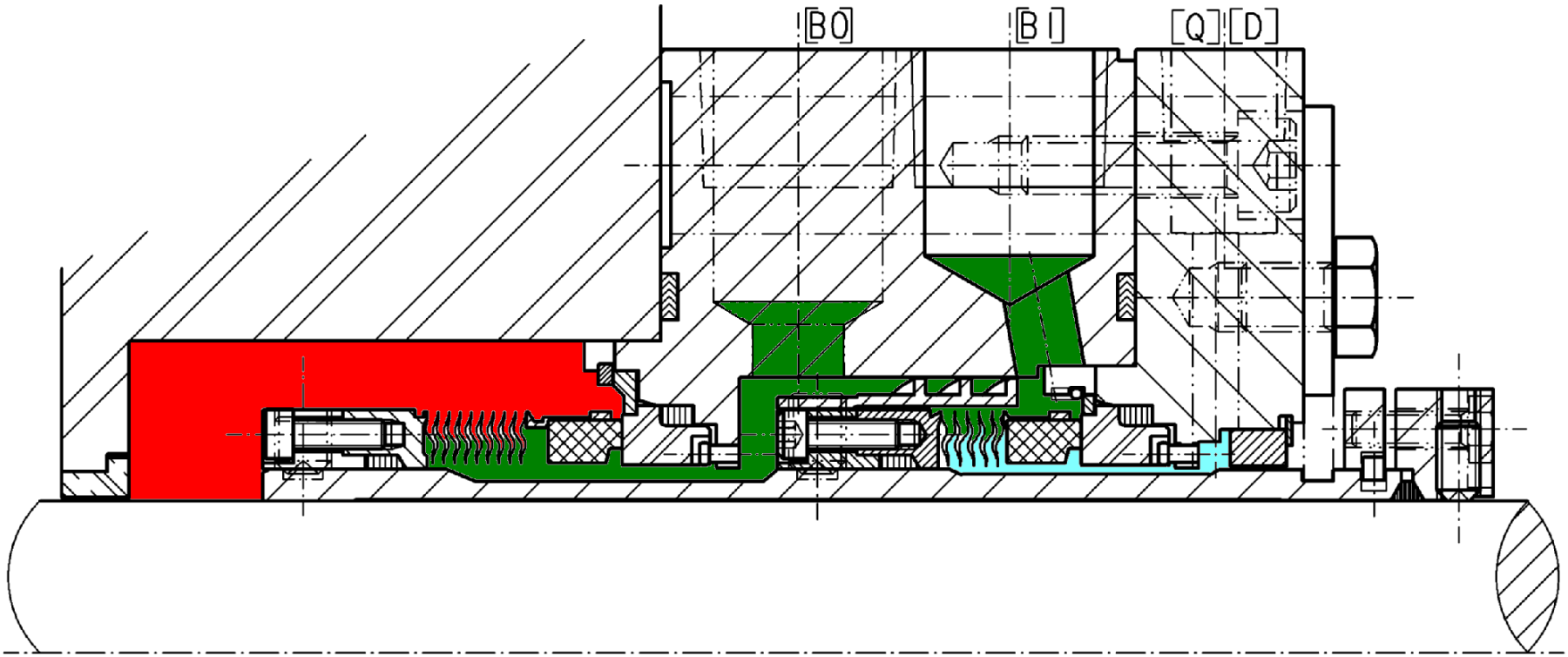
Plan 53A



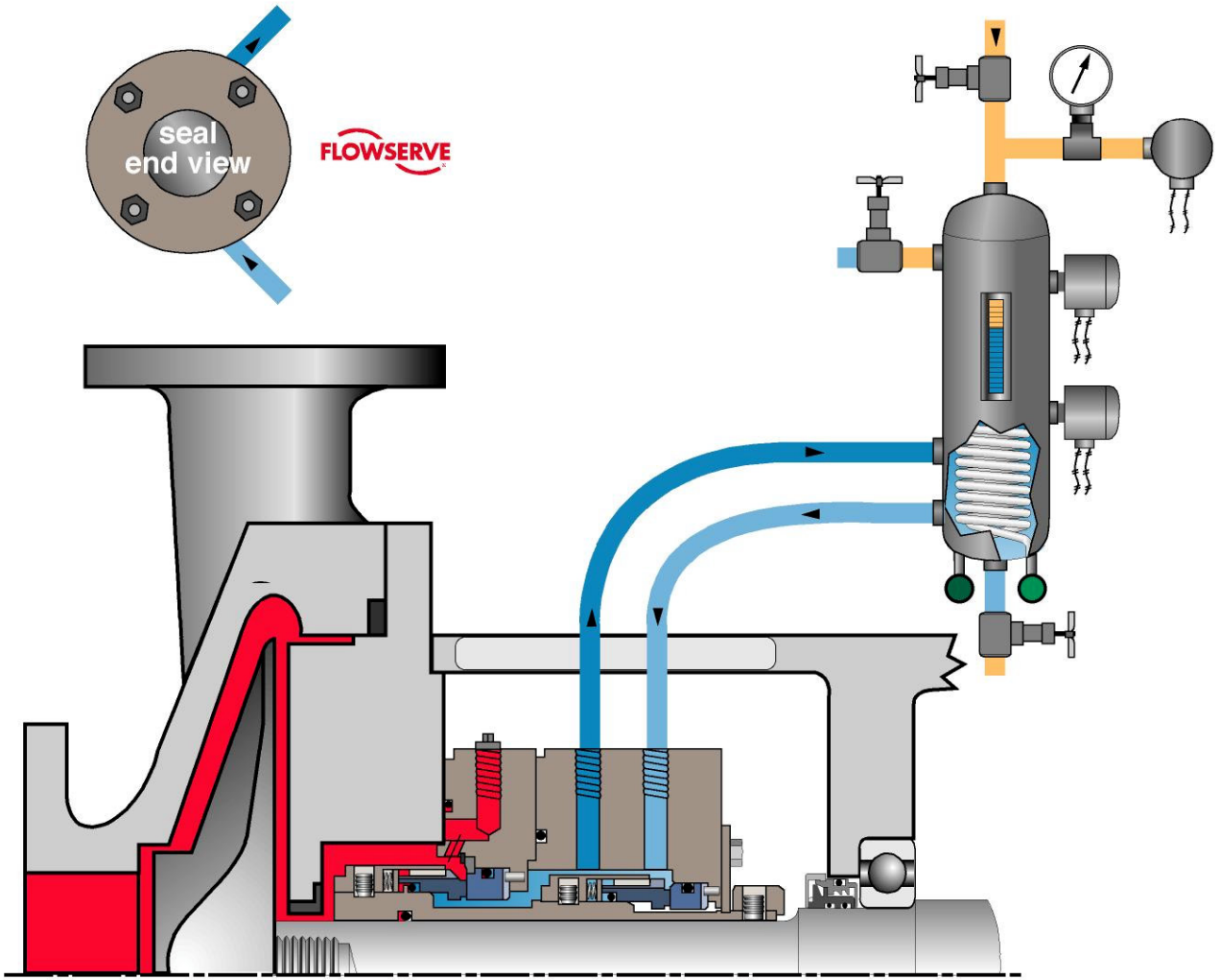
Where

- Used with dual pressurized seals (“double”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Heat transfer fluids.
- Dirty, abrasive or polymerizing fluids.
- Mixers or agitators.
- Vacuum service.

API 682 Type C Arrangement 3
3CW-FB



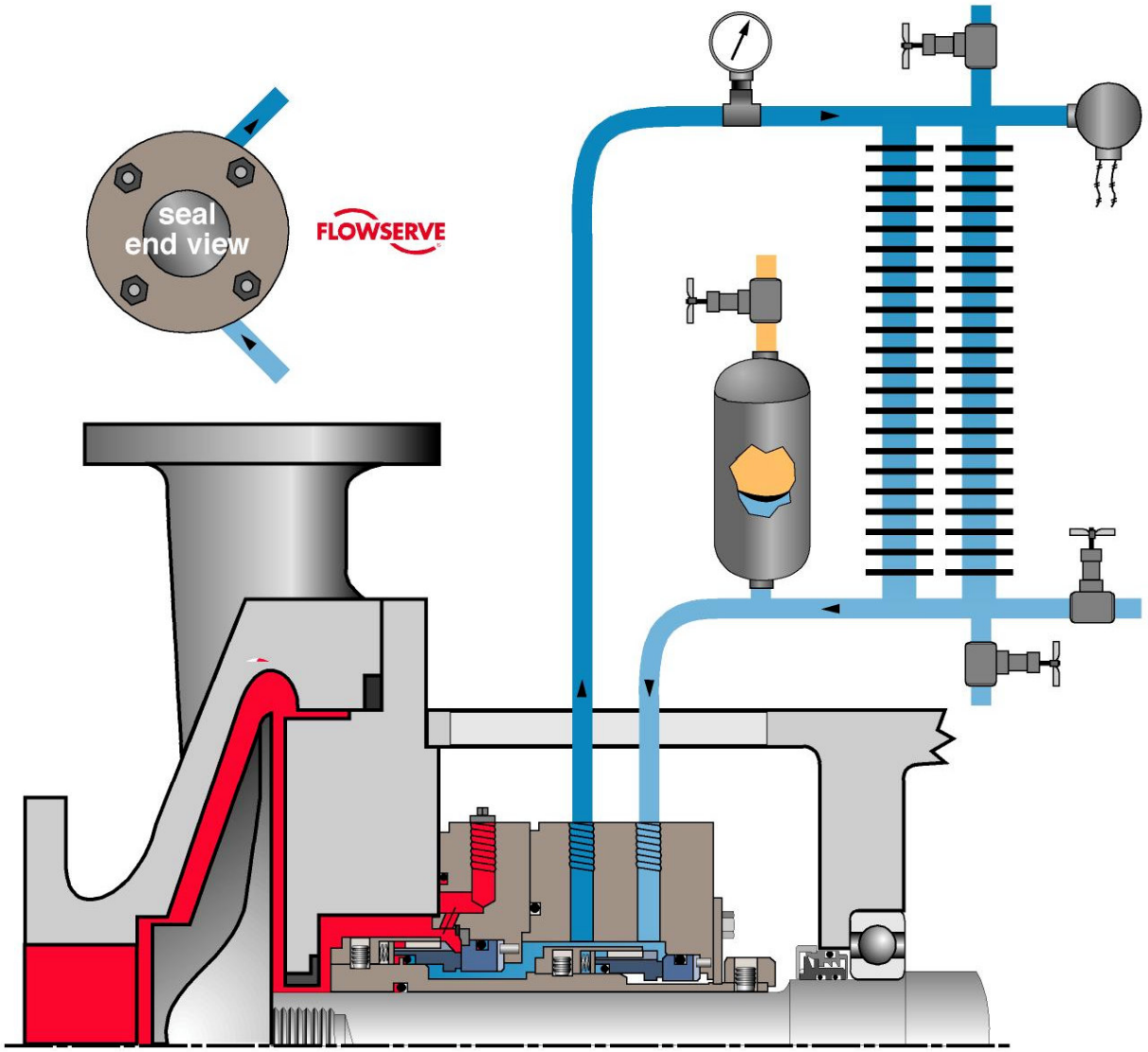
Plan 53A



Preventative Maintenance

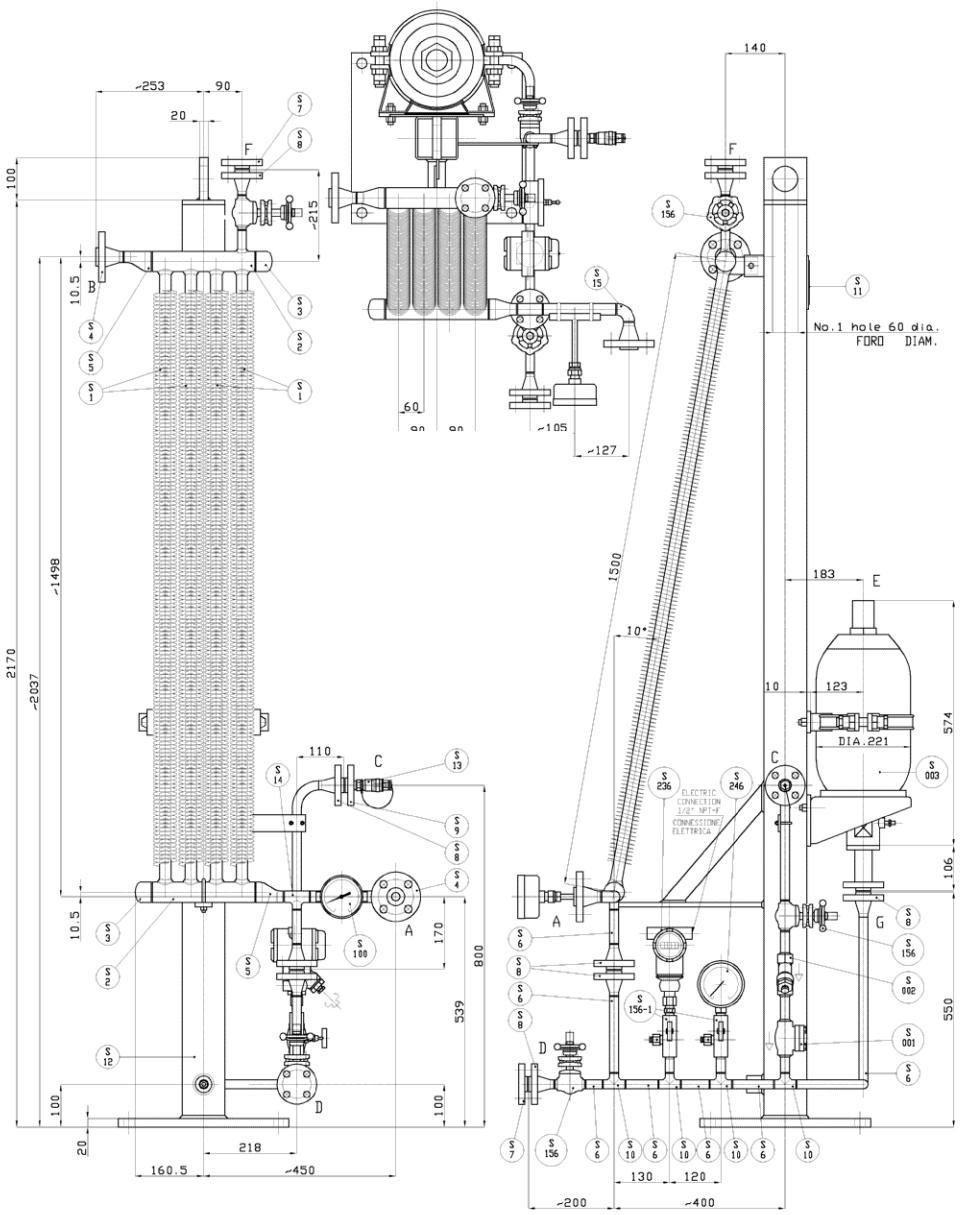
- Piping loop must self-vent to reservoir located at highest elevation.
- Pressurize reservoir at all times, maximum gas charge 150 - 200 psi (10 - 14 bar)
- Barrier fluid must be compatible with process.
- Reservoir level gage indicates both IB and OB seal leakage.

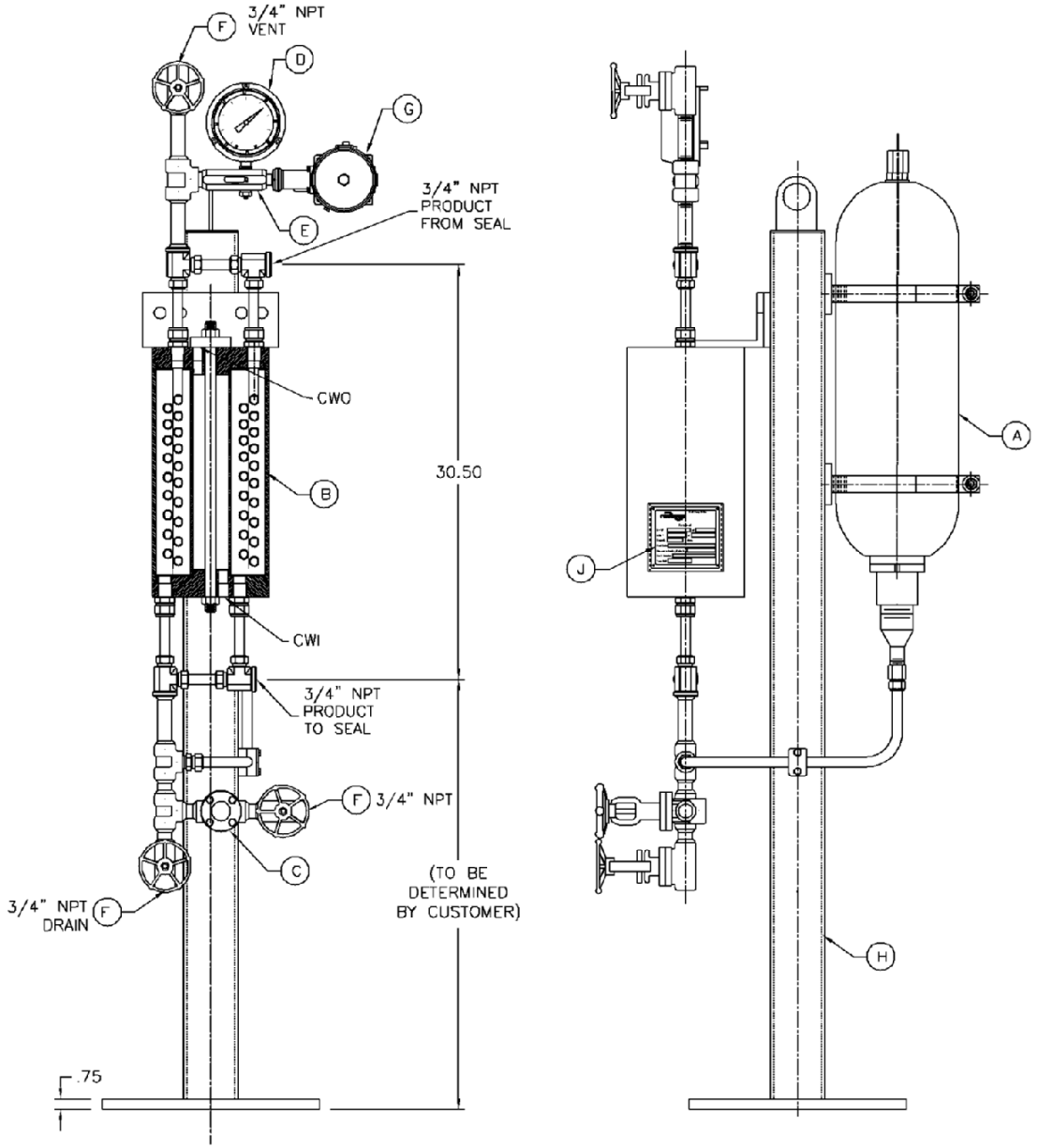
Plan 53B

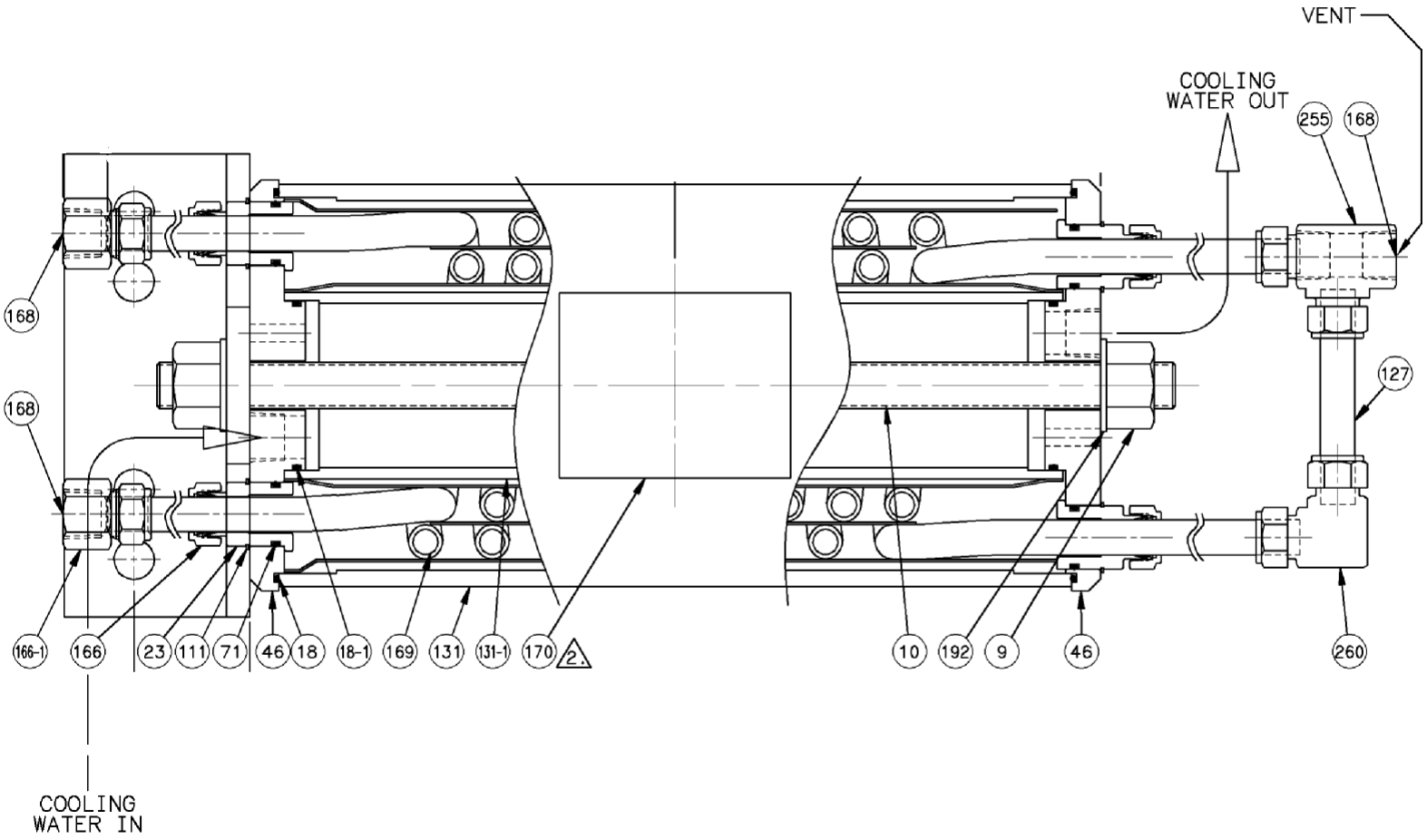


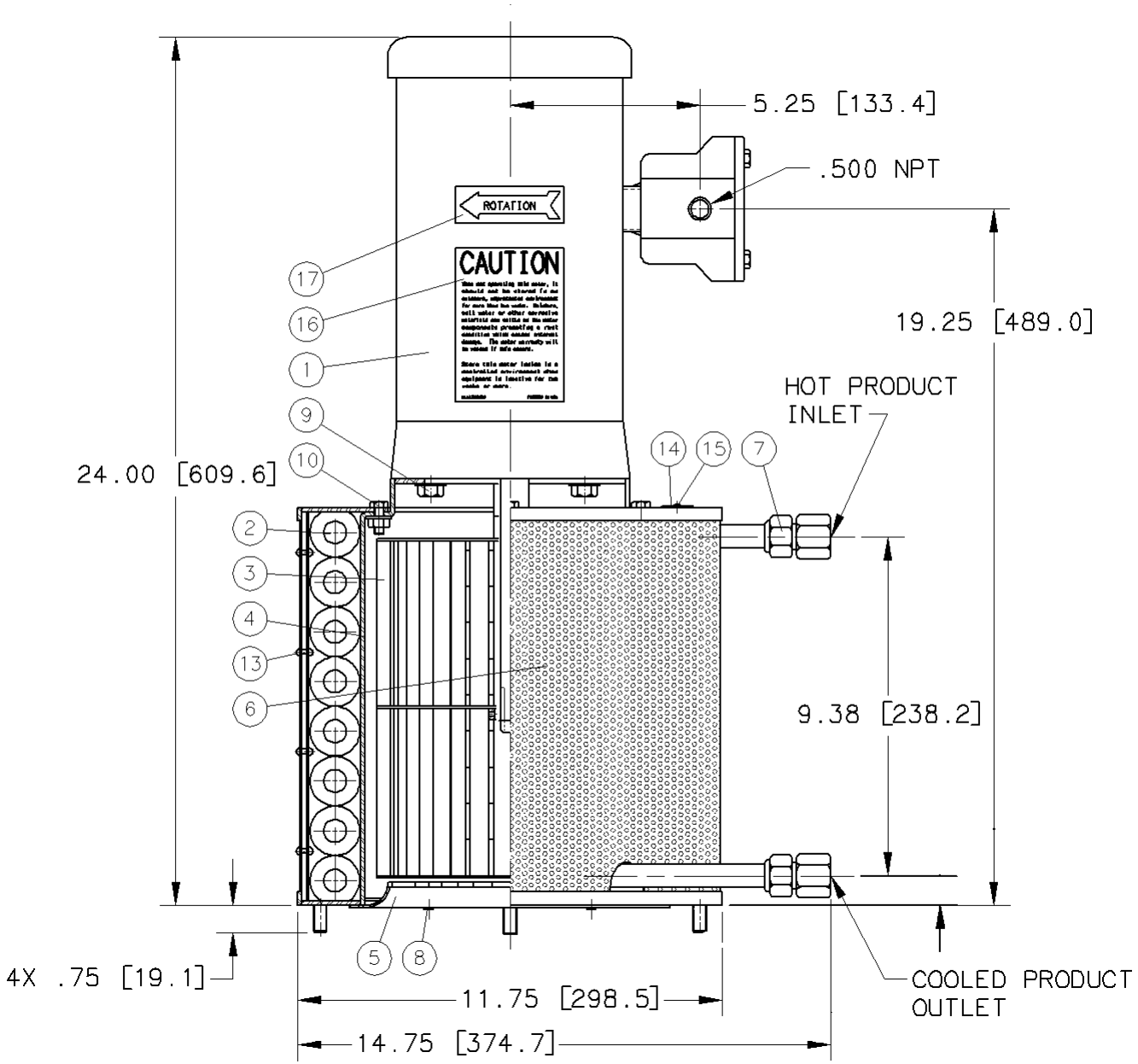
What

- Pressurized barrier fluid circulation with a bladder accumulator.
- Fluid is circulated by a pumping ring in the dual seal assembly.

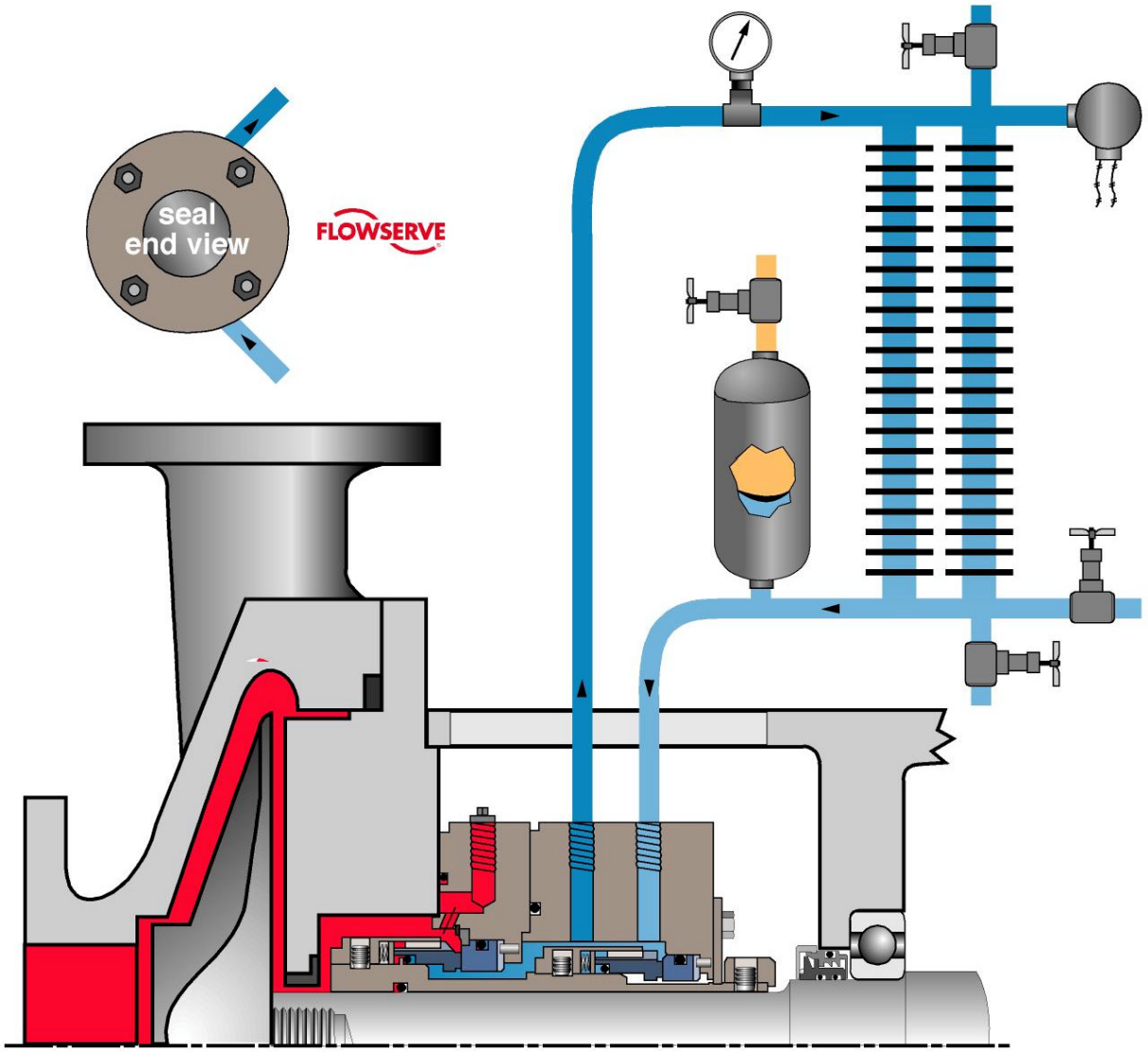

No.1 hole 60 dia.
FORO DIAM.
DIA.221
ELECTRIC CONNECTION 1/4" NPT-F
CONNESSIONE ELETTRICA


F
3/4" NPT
VENT
D
G
3/4" NPT
PRODUCT
FROM SEAL
E
CWO
B
30.50
CWI
3/4" NPT
PRODUCT
TO SEAL
F
3/4" NPT
C
(TO BE
DETERMINED
BY CUSTOMER)
3/4" NPT
DRAIN
F
.75
A
J
H


VENT
COOLING
WATER OUT
255
168
168
168
127
166-1
166
23
111
71
46
18
18-1
169
131
131-1
170
2
10
192
9
46
260
COOLING
WATER IN


5.25 [133.4]
.500 NPT
ROTATION
CAUTION
17
16
1
9
10
19.25 [489.0]
HOT PRODUCT
INLET
14
15
7
24.00 [609.6]
2
3
4
13
6
9.38 [238.2]
5
8
4X .75 [19.1]
11.75 [298.5]
14.75 [374.7]
COOLED PRODUCT
OUTLET

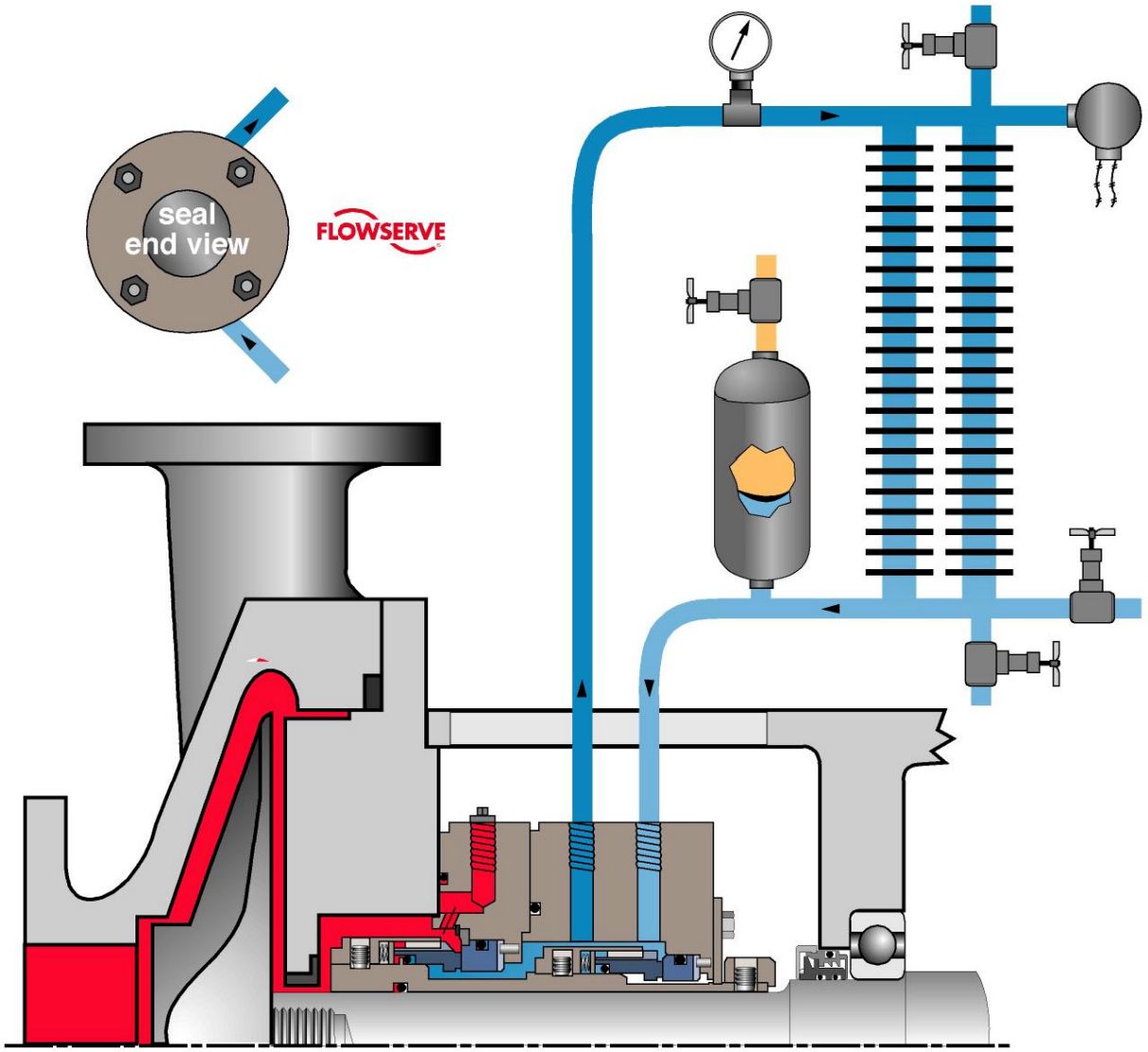
Plan 53B



Why

- Isolate process fluid.
- Zero process emissions.
- Higher pressure than Plan 53A.

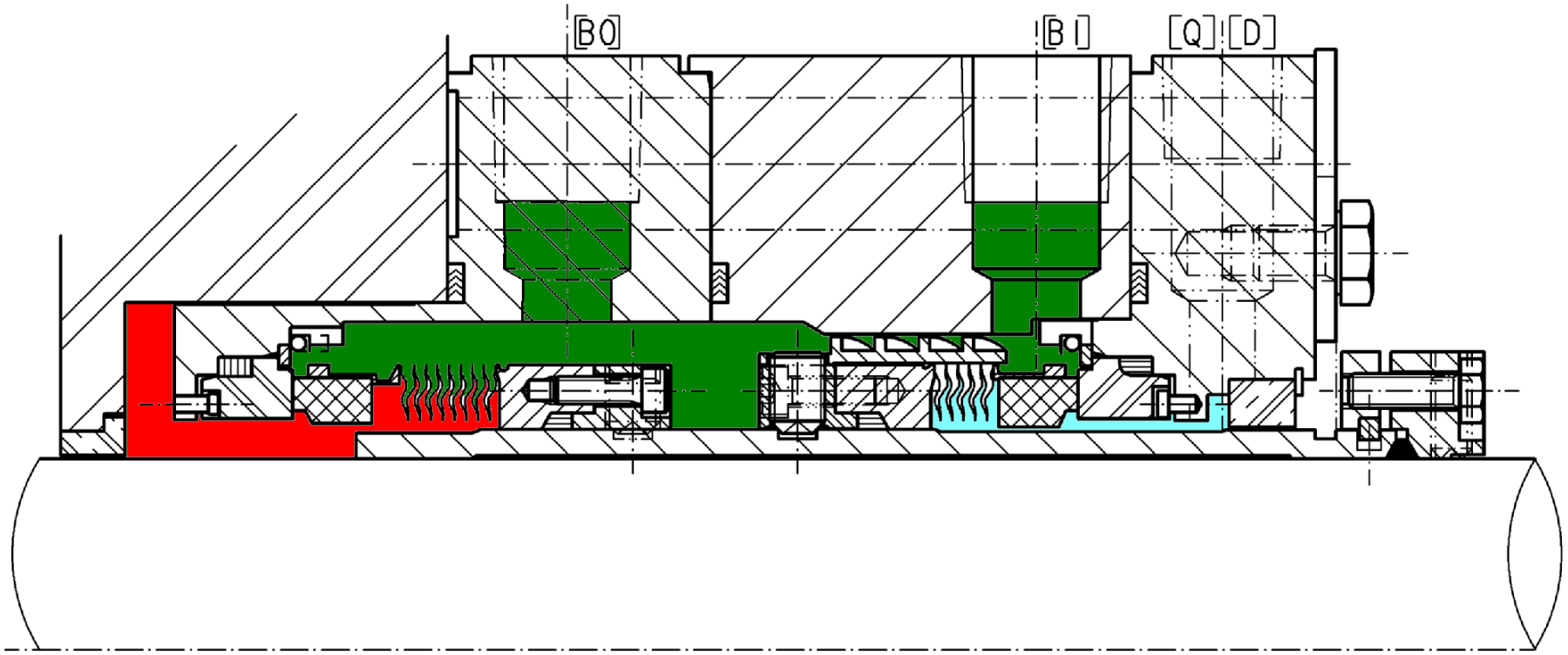
Plan 53B



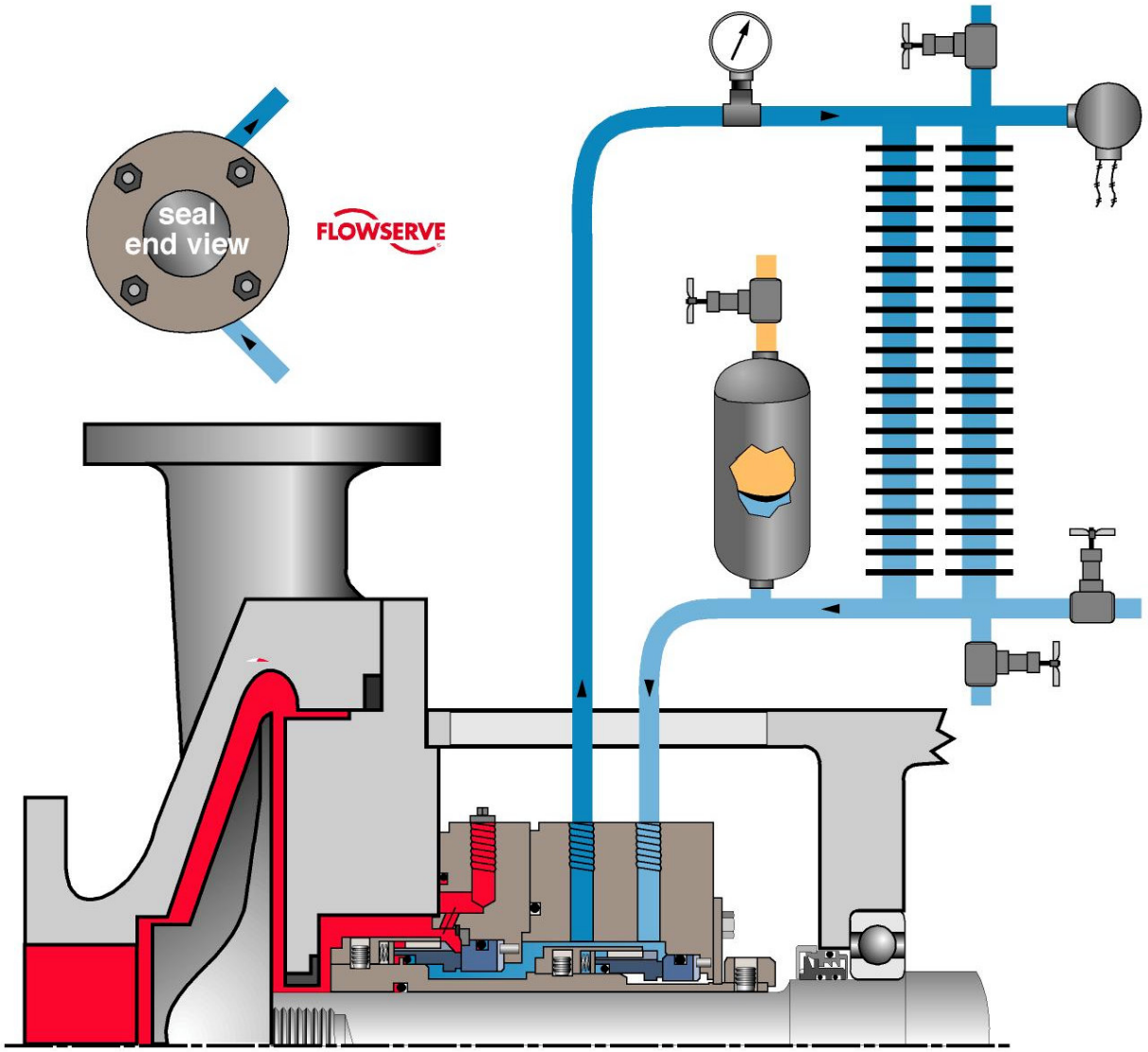
Where

- Used with dual pressurized seals (“double”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Heat transfer fluids.
- Dirty, abrasive or polymerizing fluids.

API 682 Type C Arrangement 3
3CW - BB



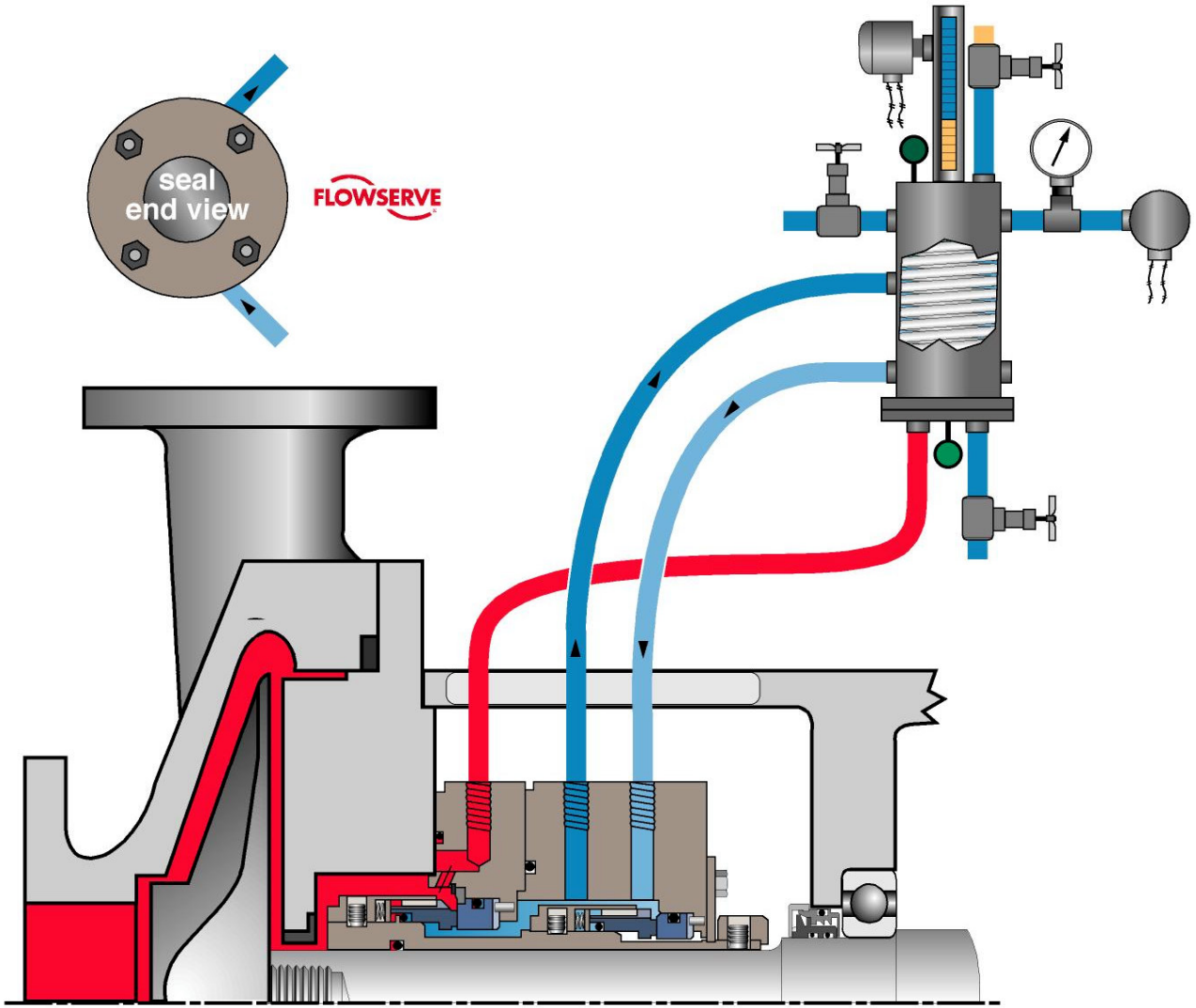
Plan 53B



Preventative Maintenance

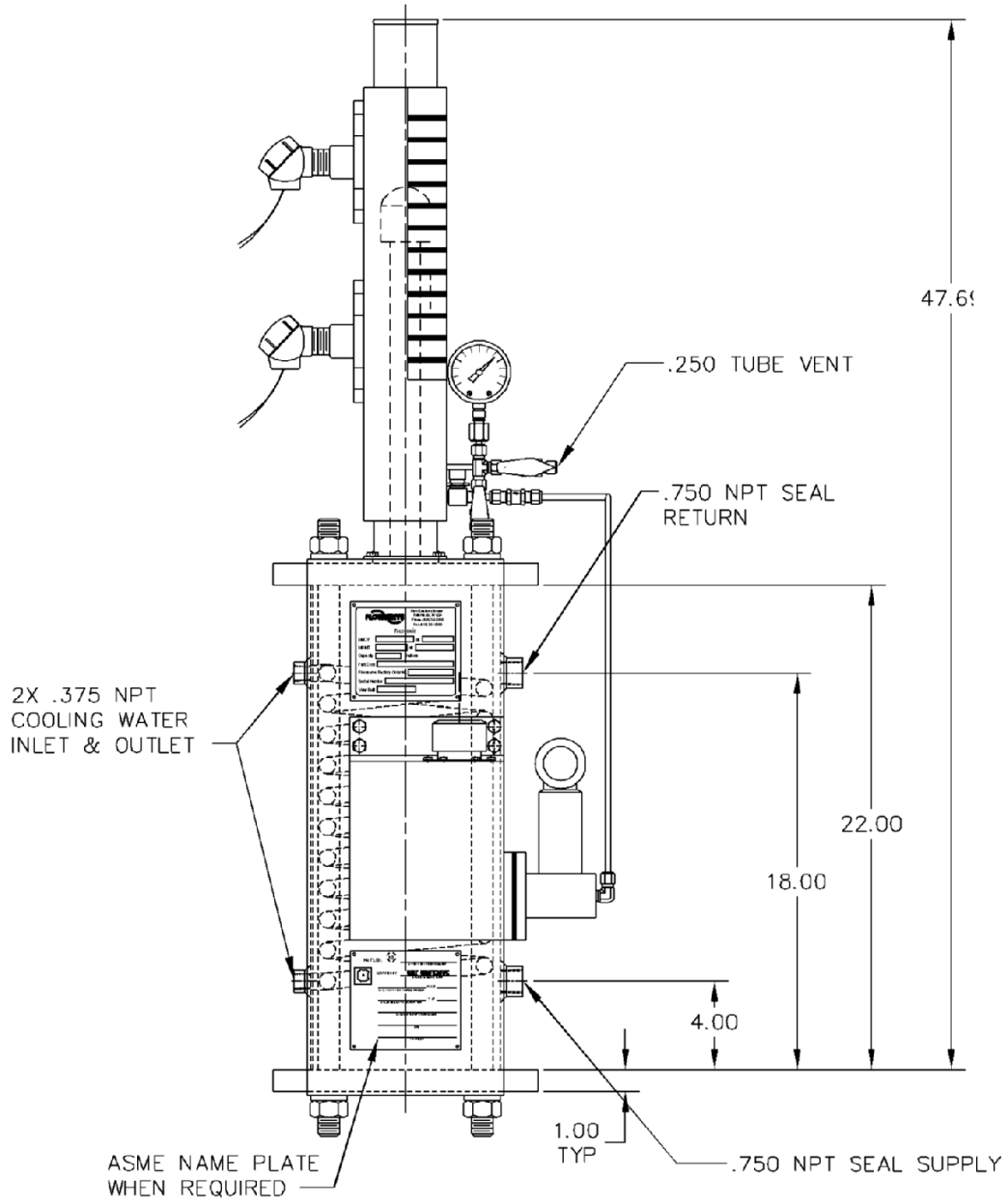
- Piping loop must be fully vented before starting.
- Accumulator must be pressurized at all times, usually by gas charge.
- Barrier fluid must be compatible with process.
- Regularly monitor barrier pressure – manually add barrier fluid when pressure decays.

Plan 53C

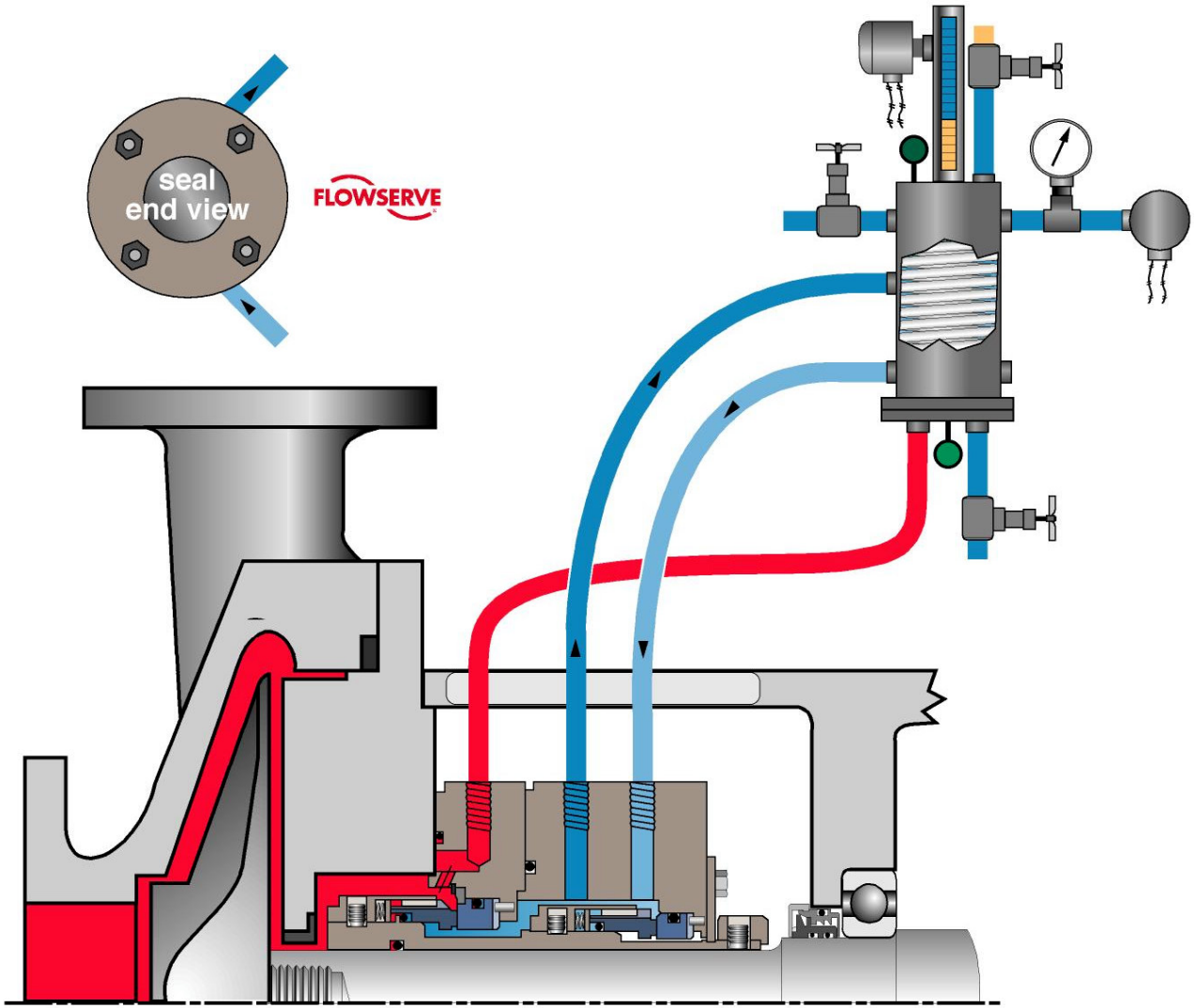


What

- Pressurized barrier fluid circulation with a piston accumulator.
- Fluid is circulated by a pumping ring in the dual seal assembly.


47.69
.250 TUBE VENT
.750 NPT SEAL
RETURN
2X .375 NPT
COOLING WATER
INLET & OUTLET
22.00
18.00
4.00
1.00
TYP
ASME NAME PLATE
WHEN REQUIRED
.750 NPT SEAL SUPPLY

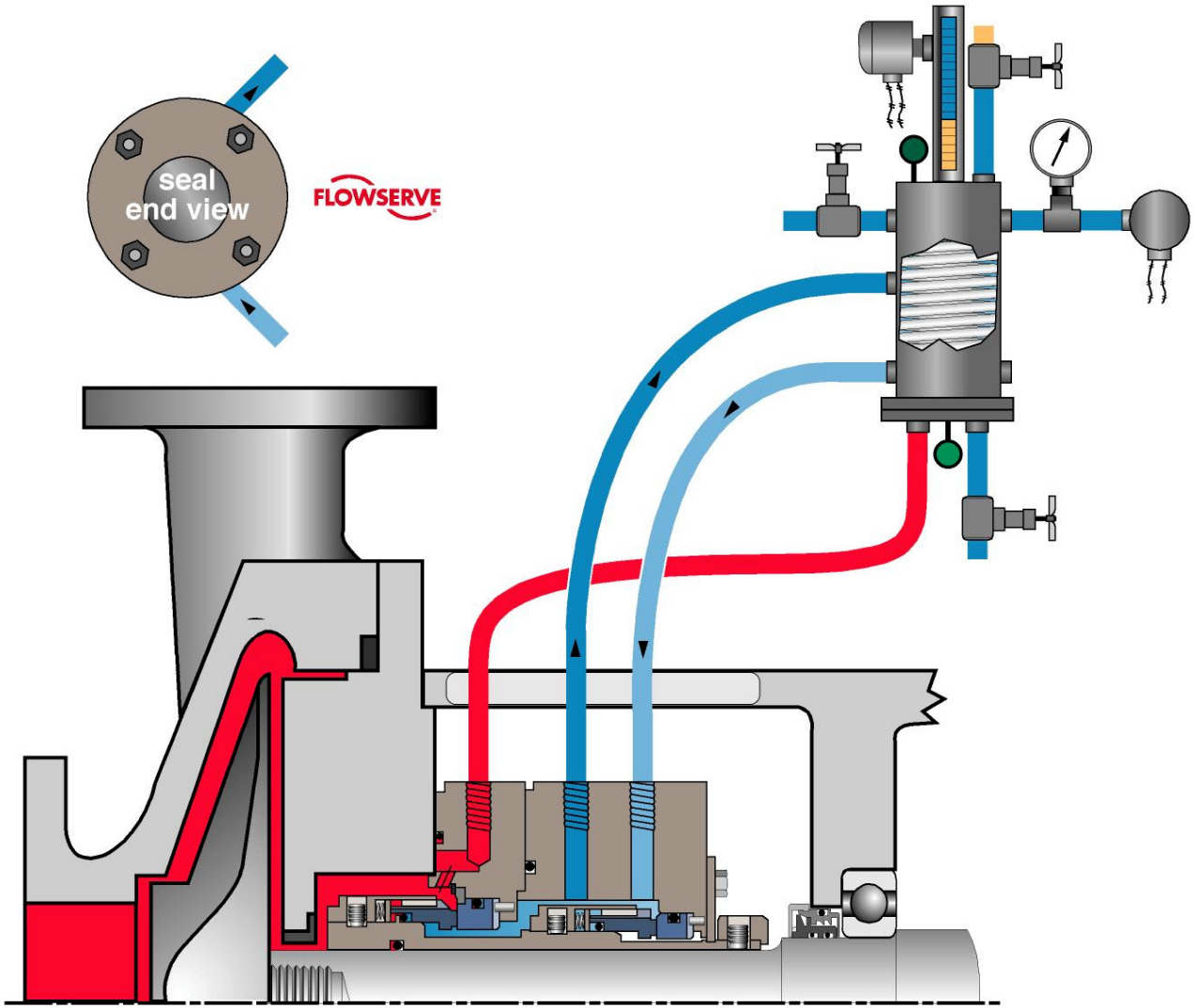
Plan 53C



Why

- Isolate process fluid.
- Zero process emissions.
- Higher pressure than Plan 53A.
- Dynamic tracking of system pressure.

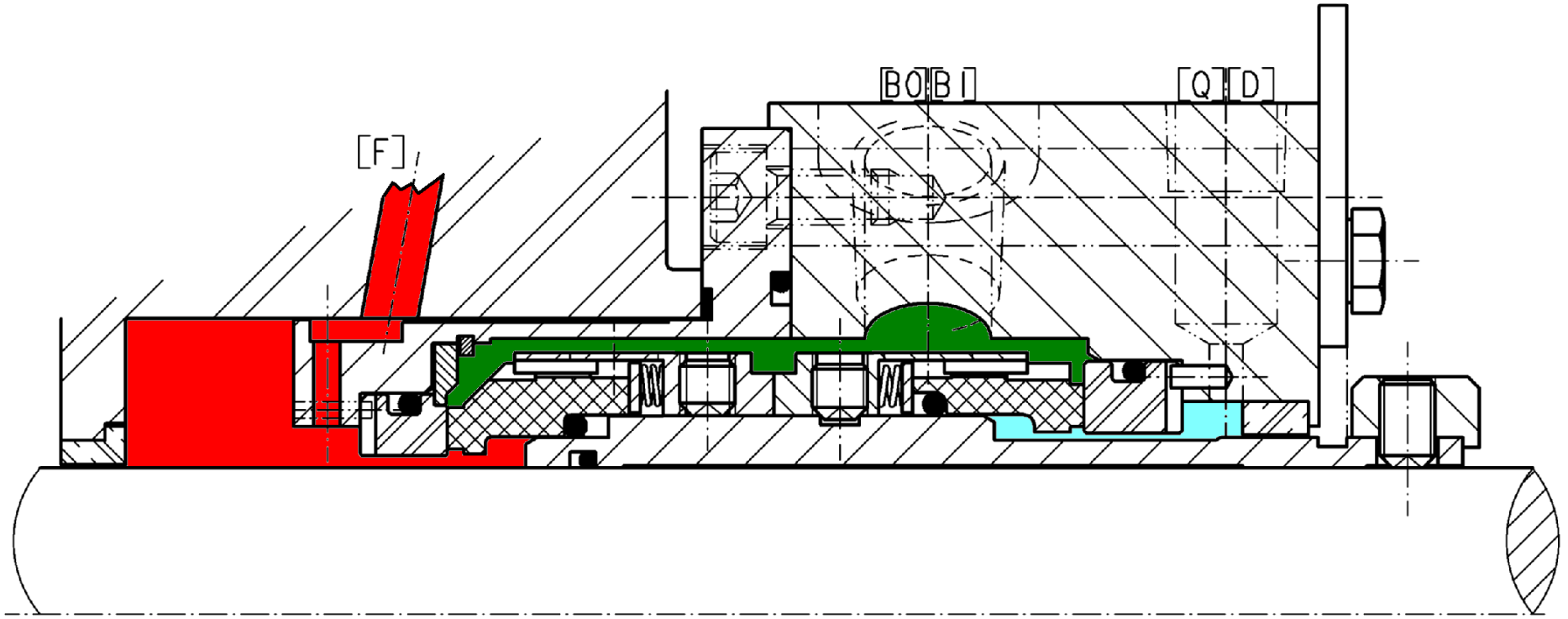
Plan 53C



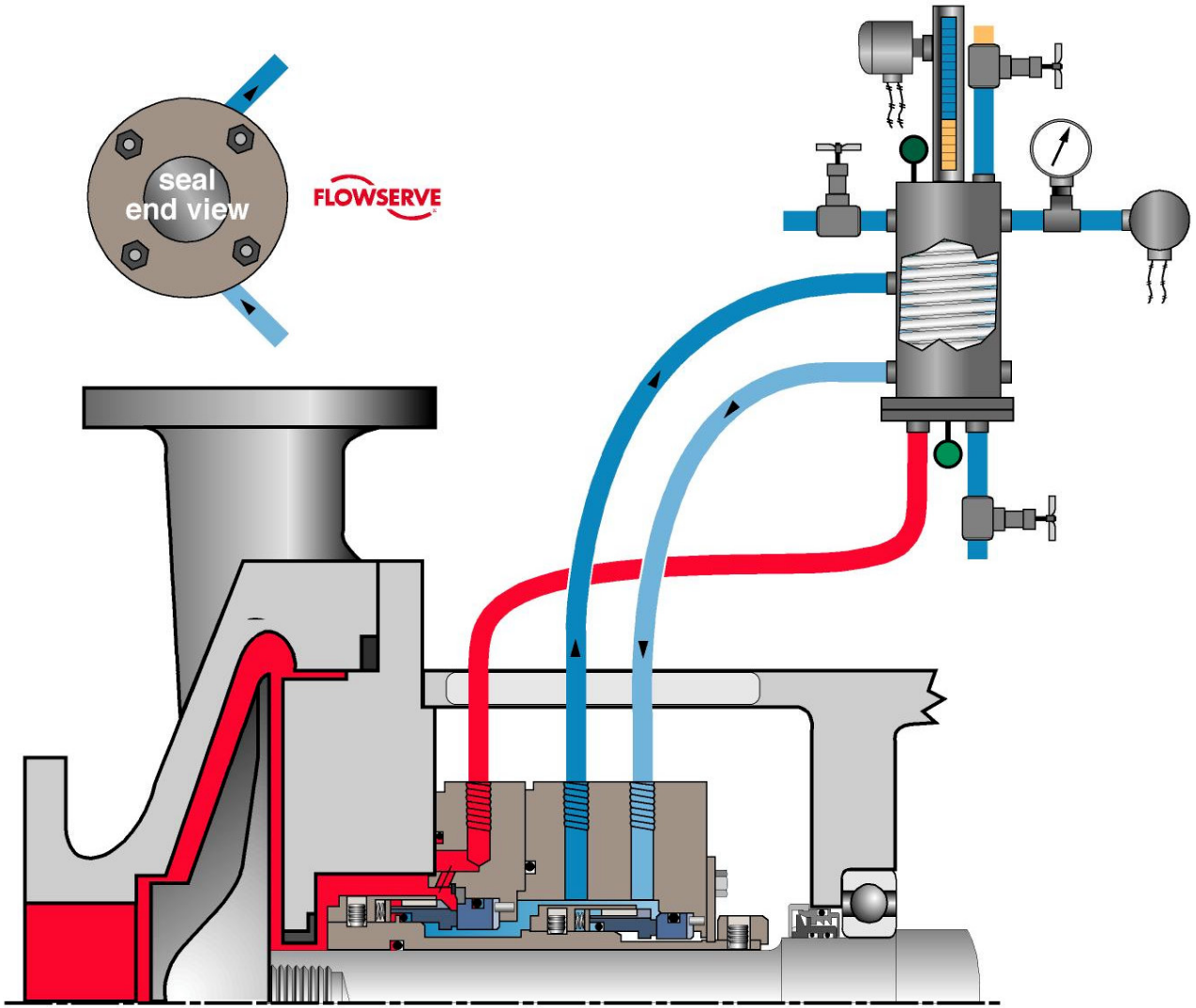
Where

- Used with dual pressurized seals (“double”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Heat transfer fluids.

API 682 Type A Arrangement 3
3CW - BB



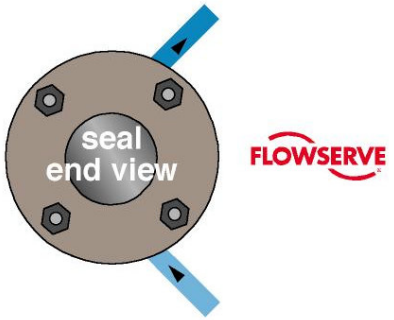
Plan 53C

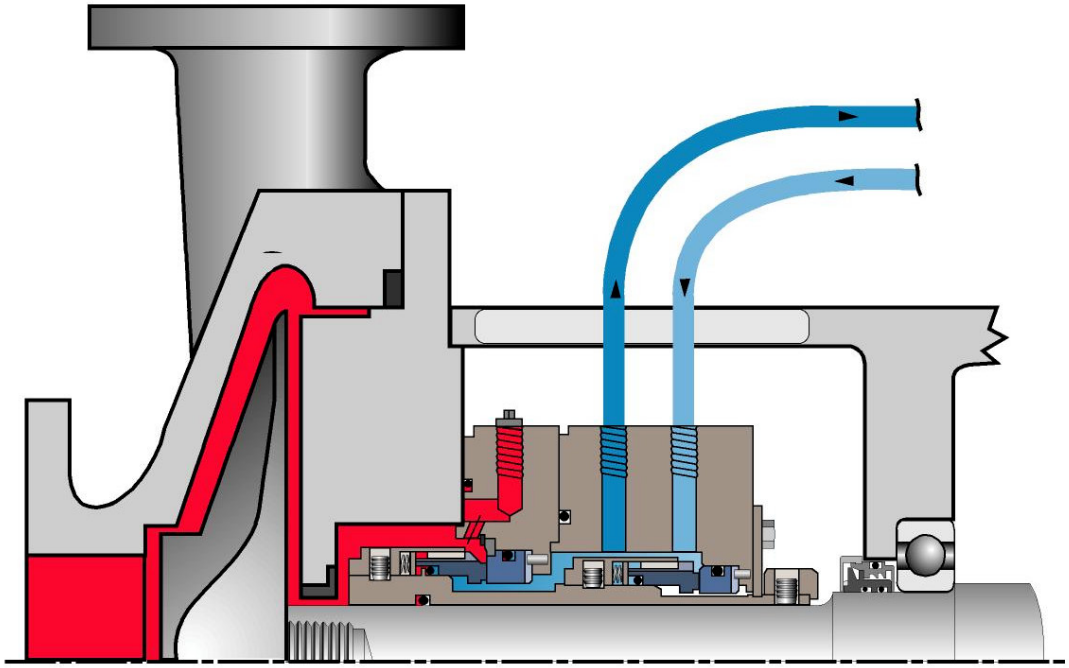


Preventative Maintenance

- Piping loop must be fully vented before starting.
- Reference line must tolerate process contamination without plugging.
- Barrier fluid must be compatible with process.
- Reservoir level gage indicates both inboard and outboard seal leakage.

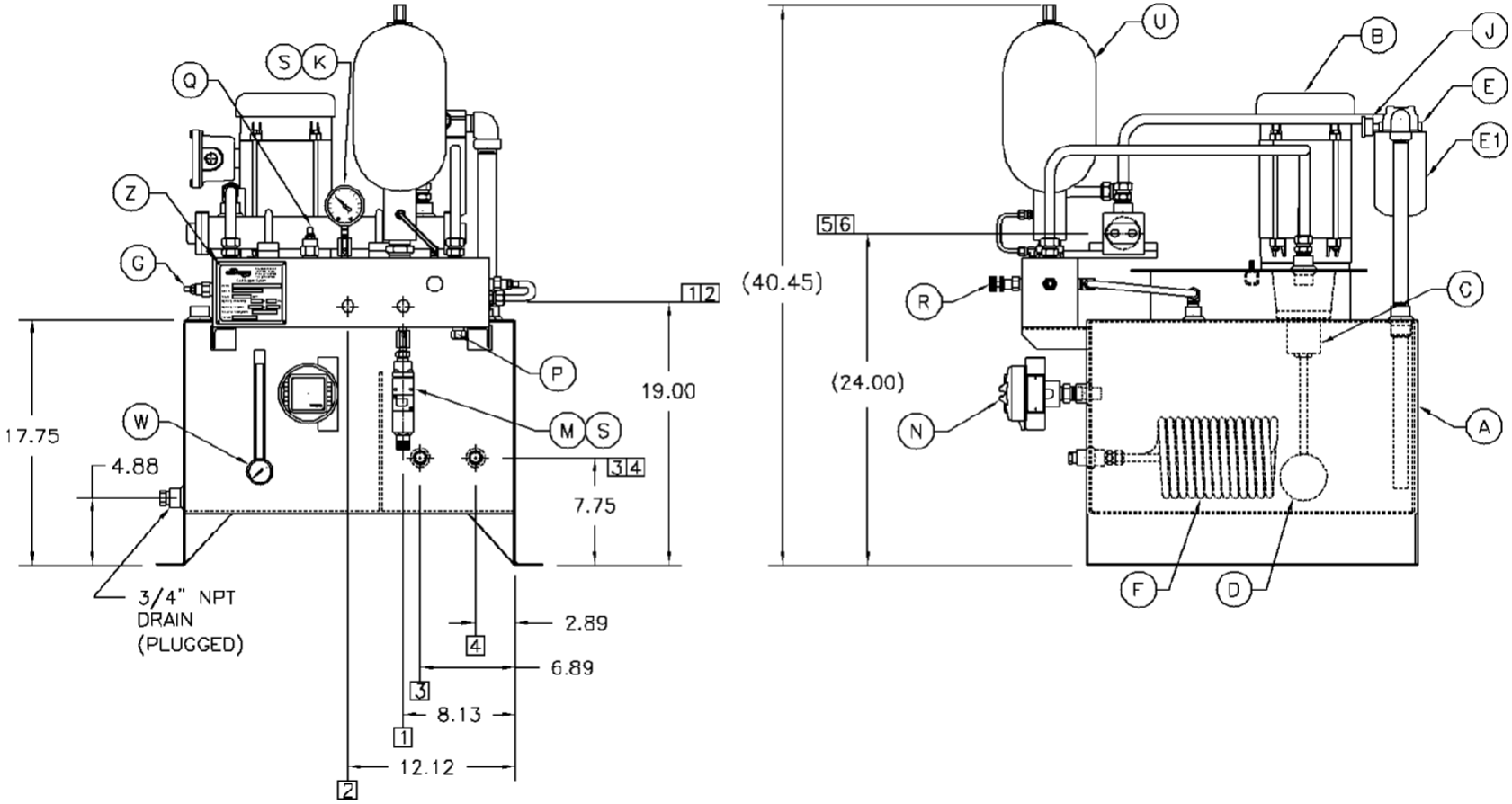
Plan 54



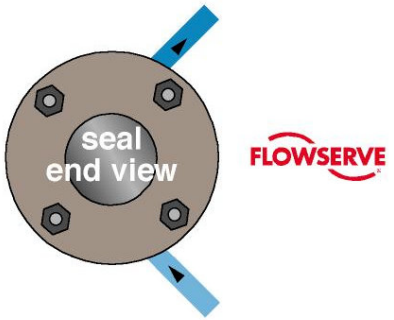


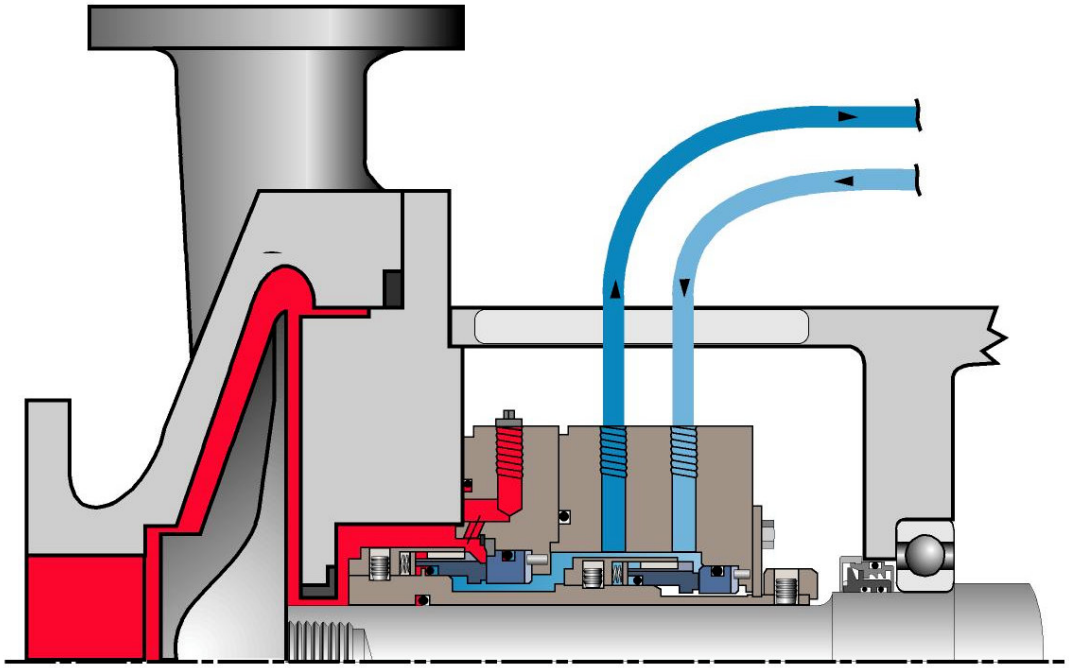
What

- Pressurized barrier fluid circulation by an external system.


Q
S
K
Z
G
W
P
M
S
12
34
19.00
17.75
4.88
7.75
3/4" NPT
DRAIN
(PLUGGED)
4
2.89
3
6.89
1
8.13
2
12.12
U
B
J
E
E1
56
(40.45)
R
C
(24.00)
N
A
F
D

Plan 54

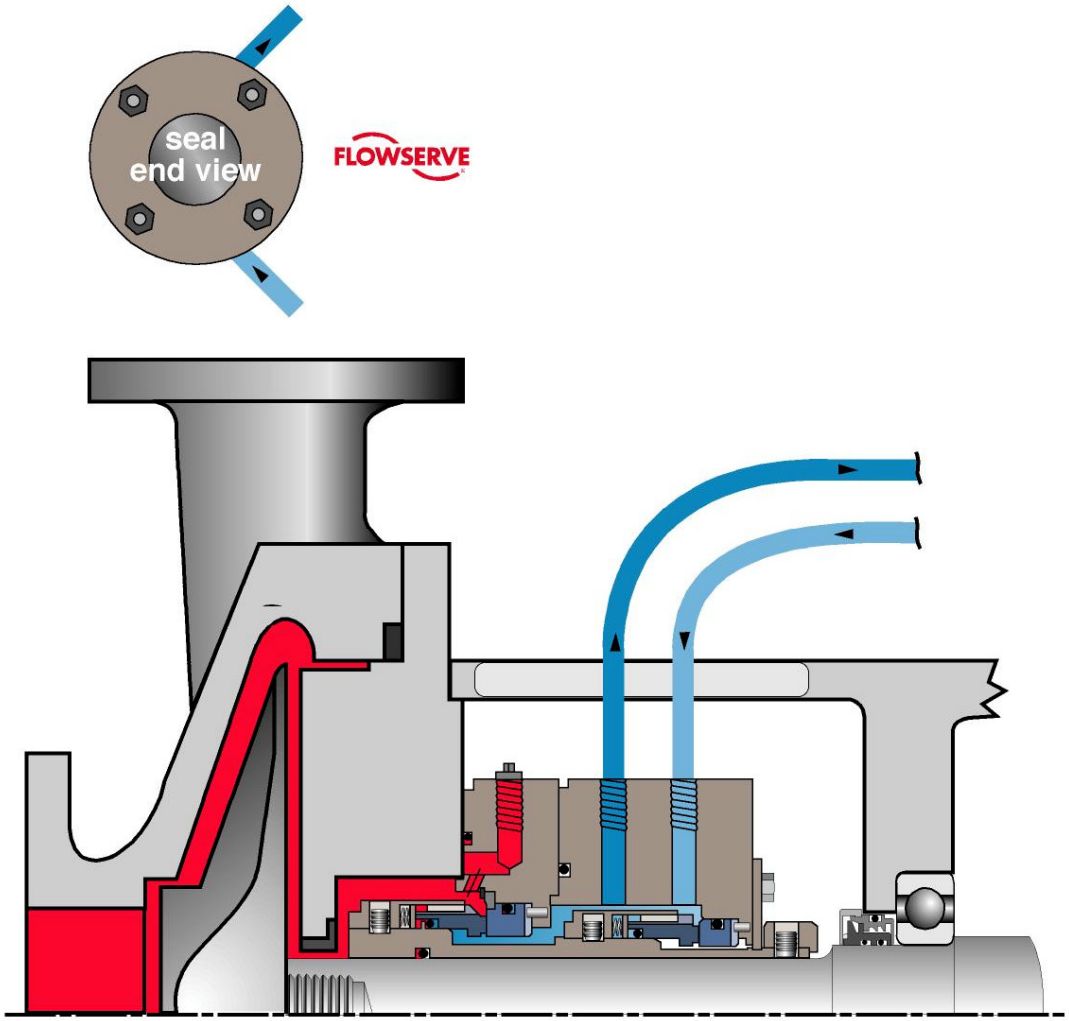




Why

- Isolate process fluid.
- Zero process emissions.
- Seal cannot induce circulation.

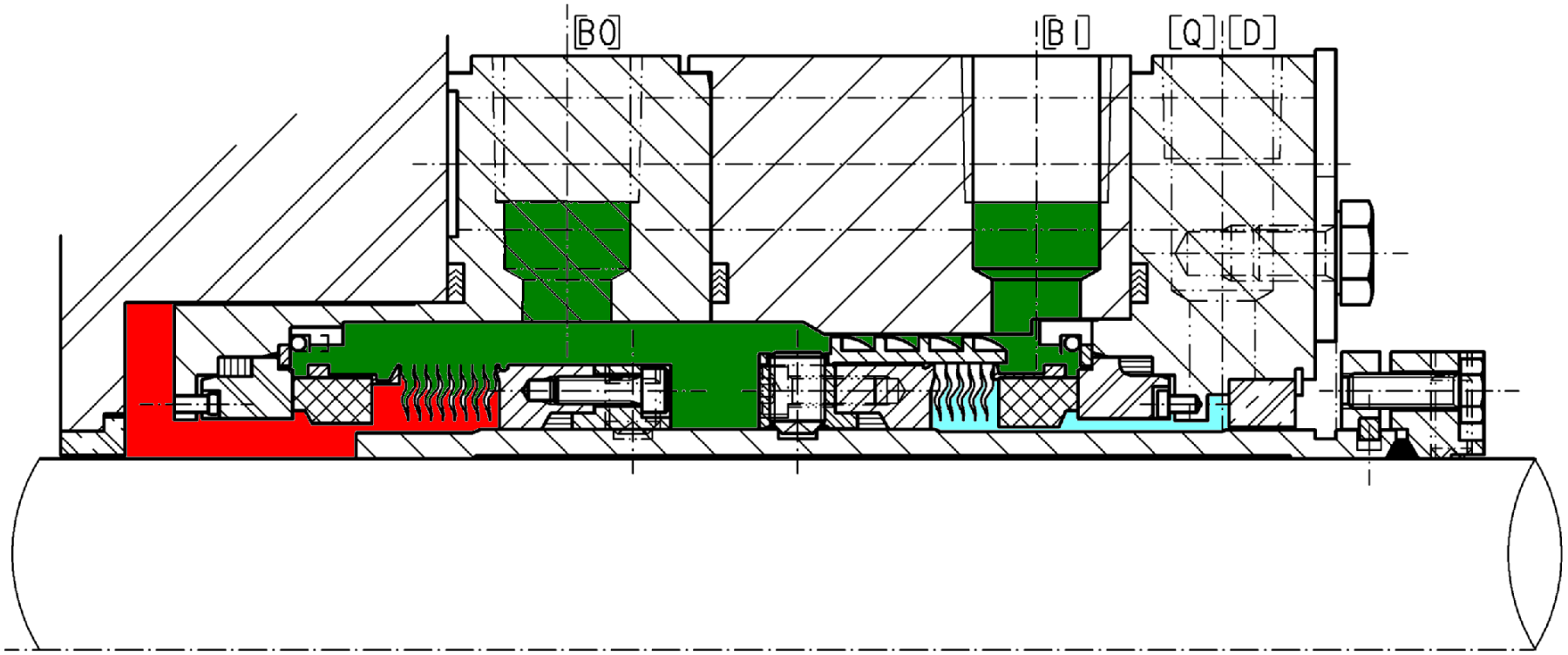
Plan 54



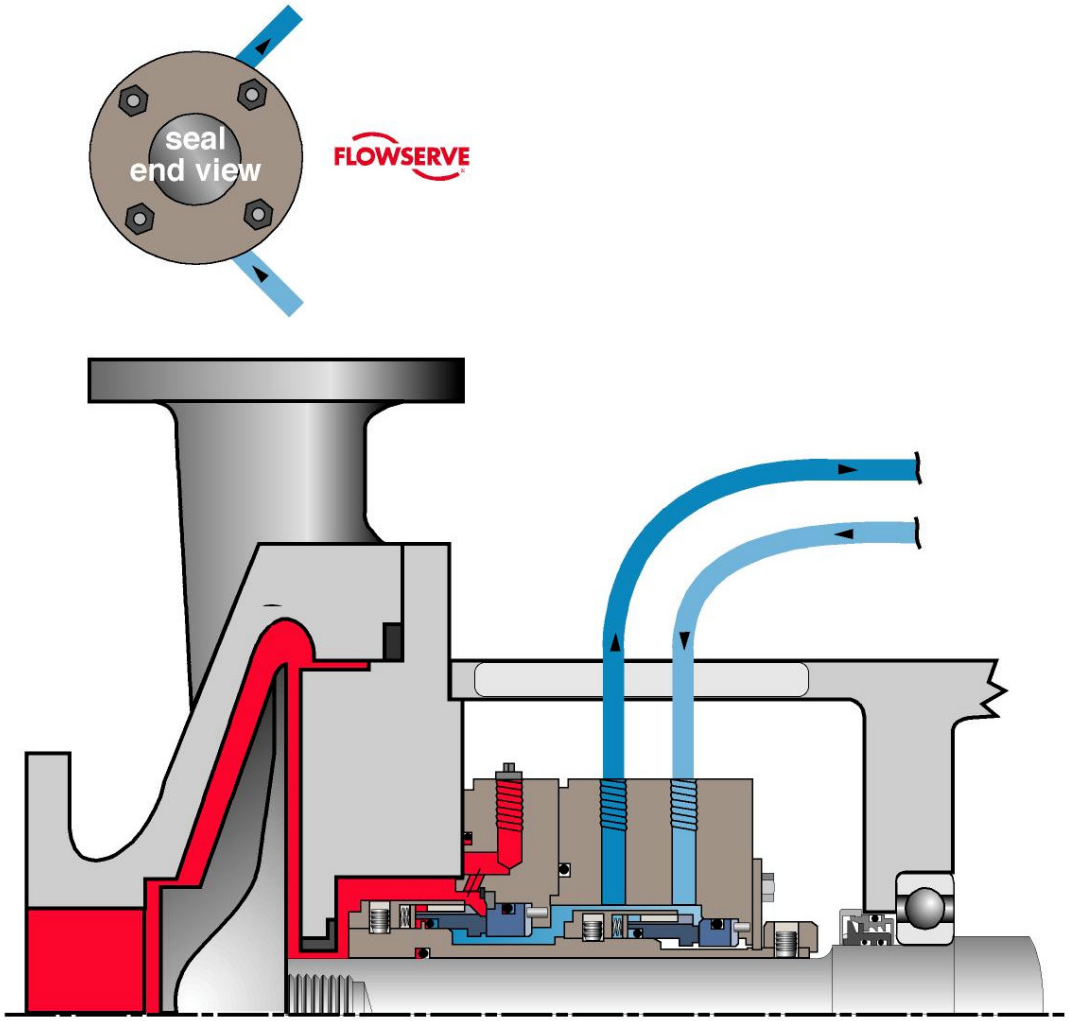
Where

- Used with dual pressurized seals (“double”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Heat transfer fluids.
- Dirty, abrasive, or polymerizing fluids.
- Mixers or agitators.

API 682 Type C Arrangement 3
3CW - BB



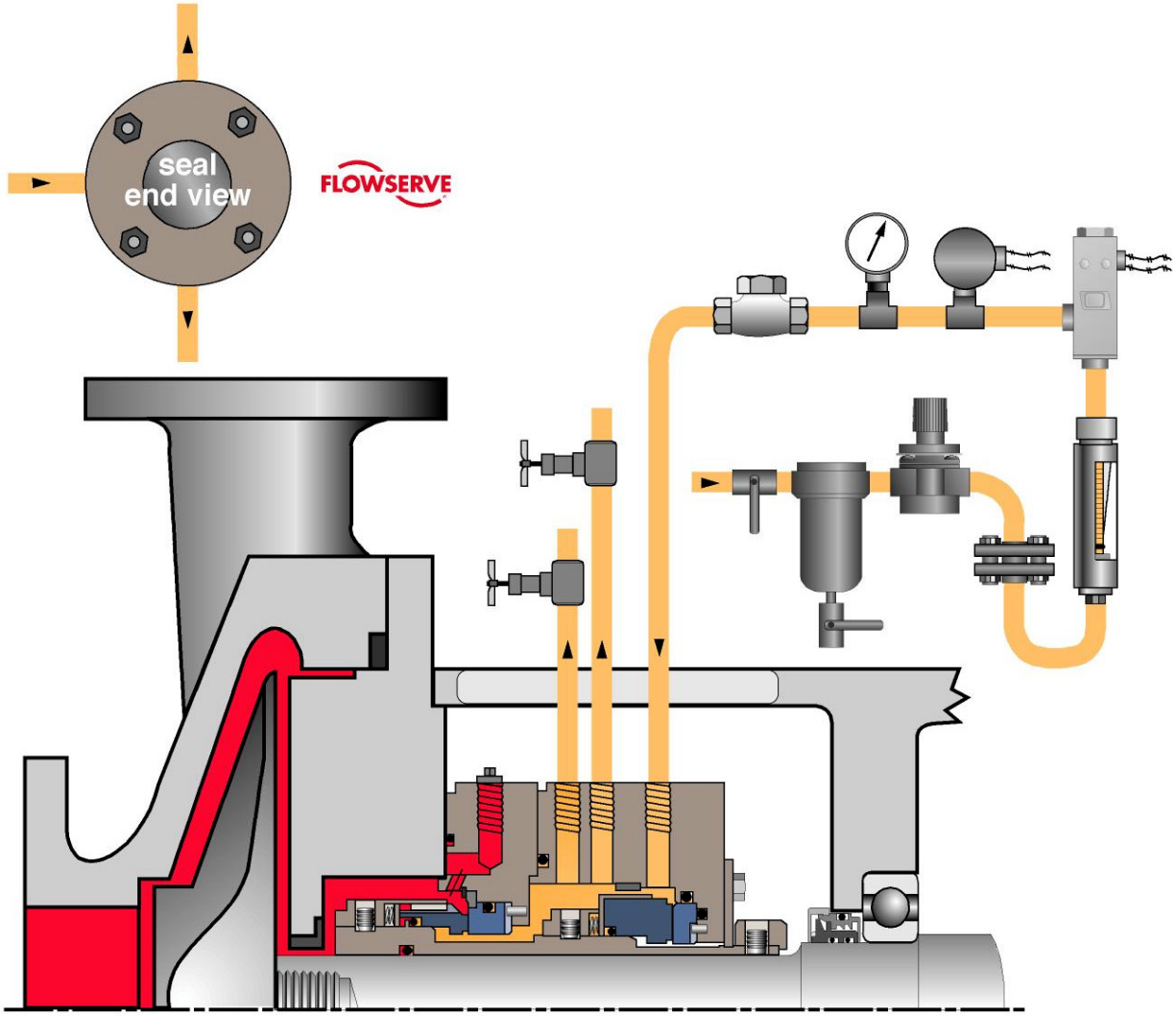
Plan 54



Preventative Maintenance

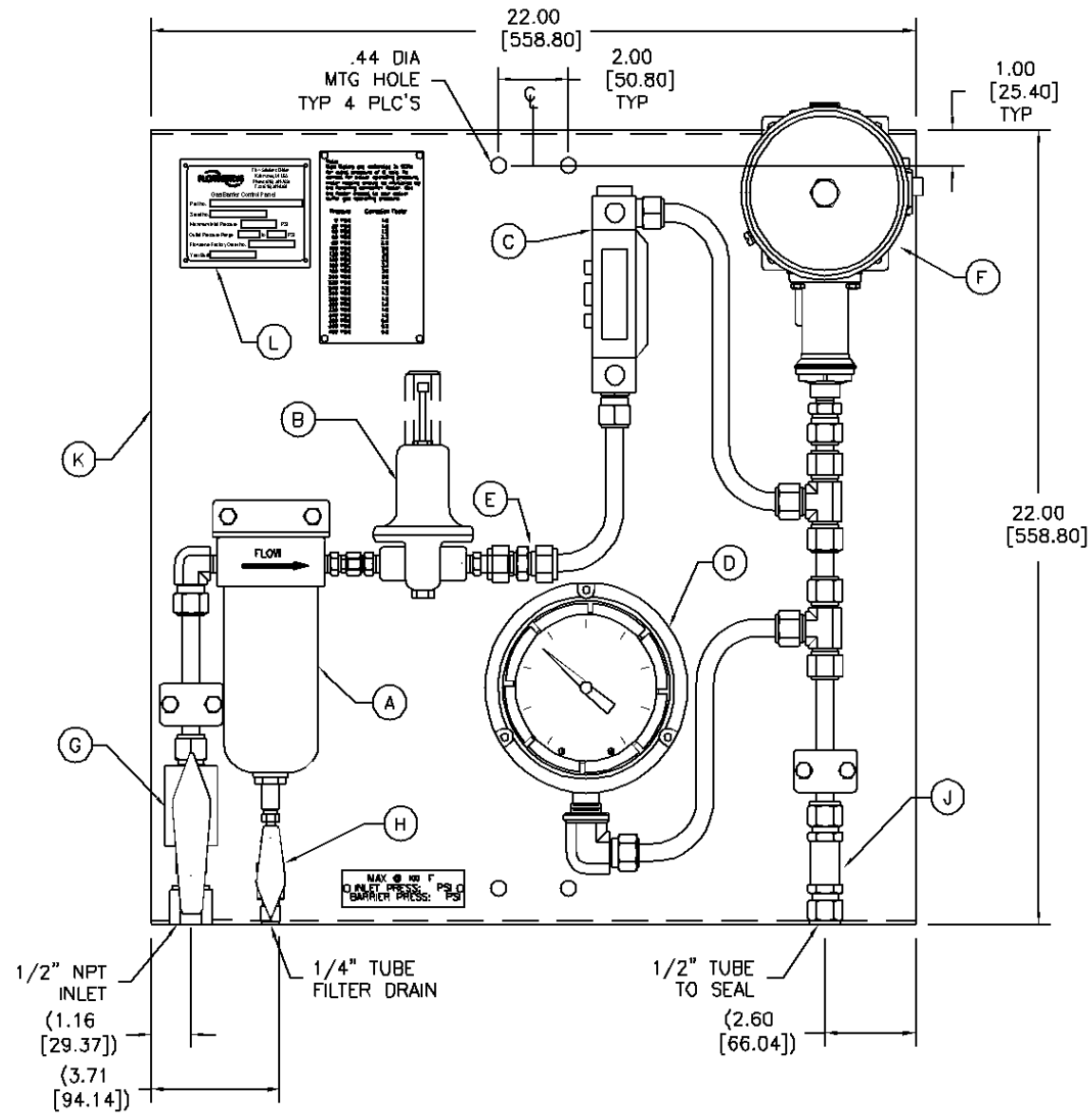
- Piping loop must be fully vented before starting.
- Circulating system must be pressurized and energized at all times.
- Barrier fluid must be compatible with process.
- Circulation system level gage indicates both inboard and outboard seal leakage.

Plan 72

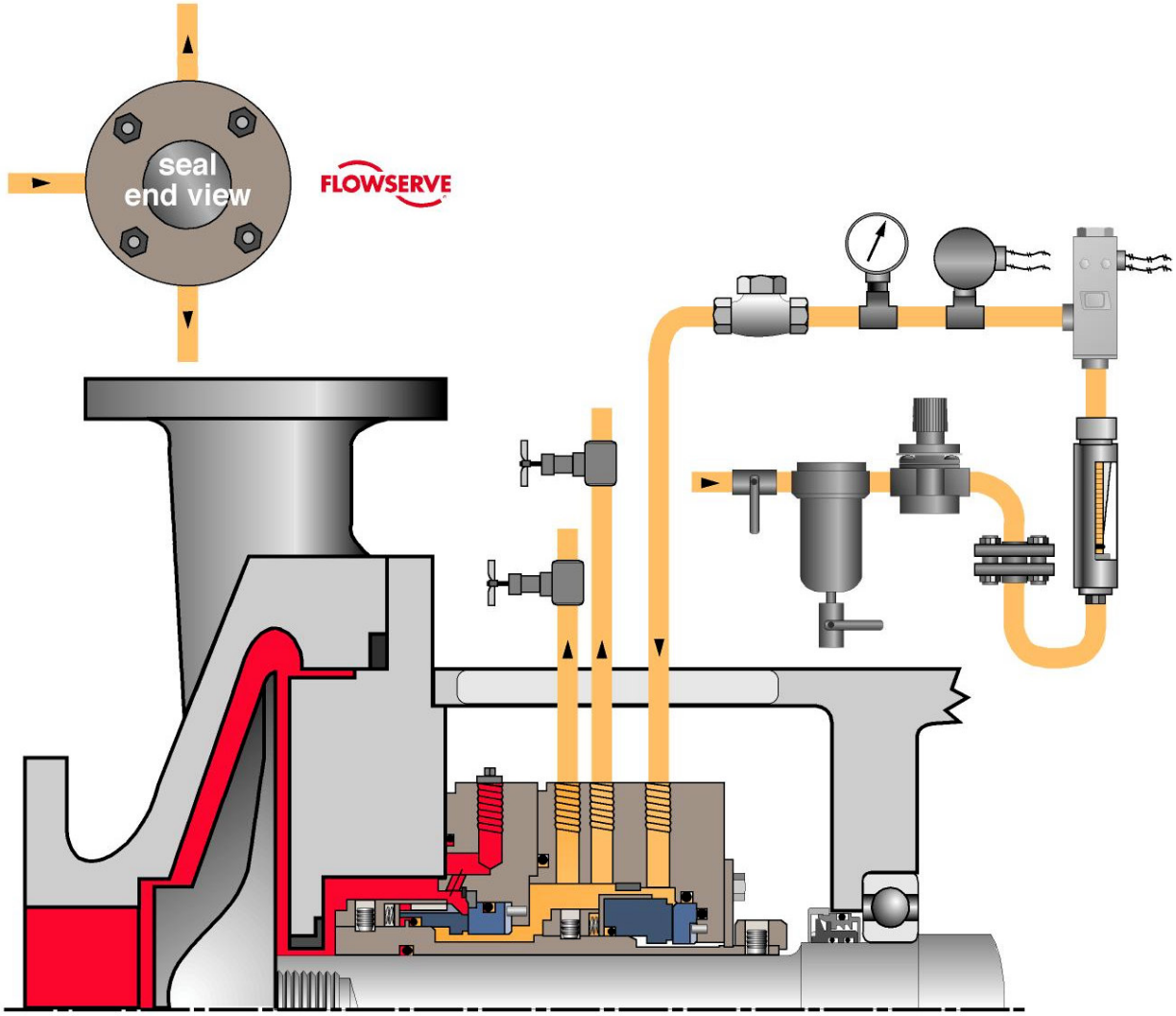


What

- Unpressurized buffer gas control system.
- Containment seal support typically with nitrogen buffer gas.


22.00
[558.80]
.44 DIA
MTG HOLE
TYP 4 PLC'S
2.00
[50.80]
TYP
1.00
[25.40]
TYP
22.00
[558.80]
FLOW
A
B
C
D
E
F
G
H
J
K
L
1/2" NPT
INLET
(1.16
[29.37])
(3.71
[94.14])
1/4" TUBE
FILTER DRAIN
1/2" TUBE
TO SEAL
(2.60
[66.04])

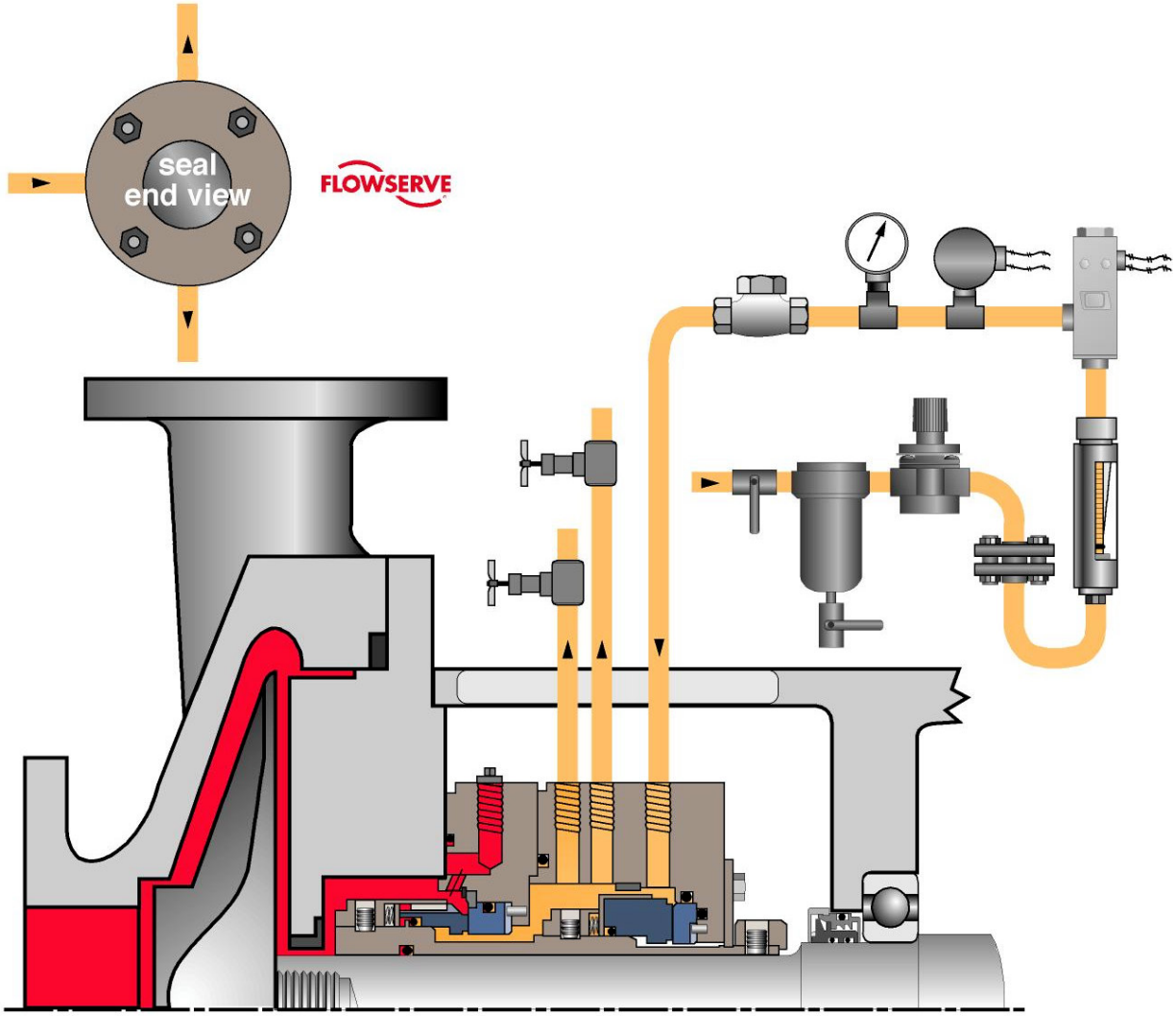
Plan 72



Why

- Zero to very low process emissions.
- Safety backup to primary seal.

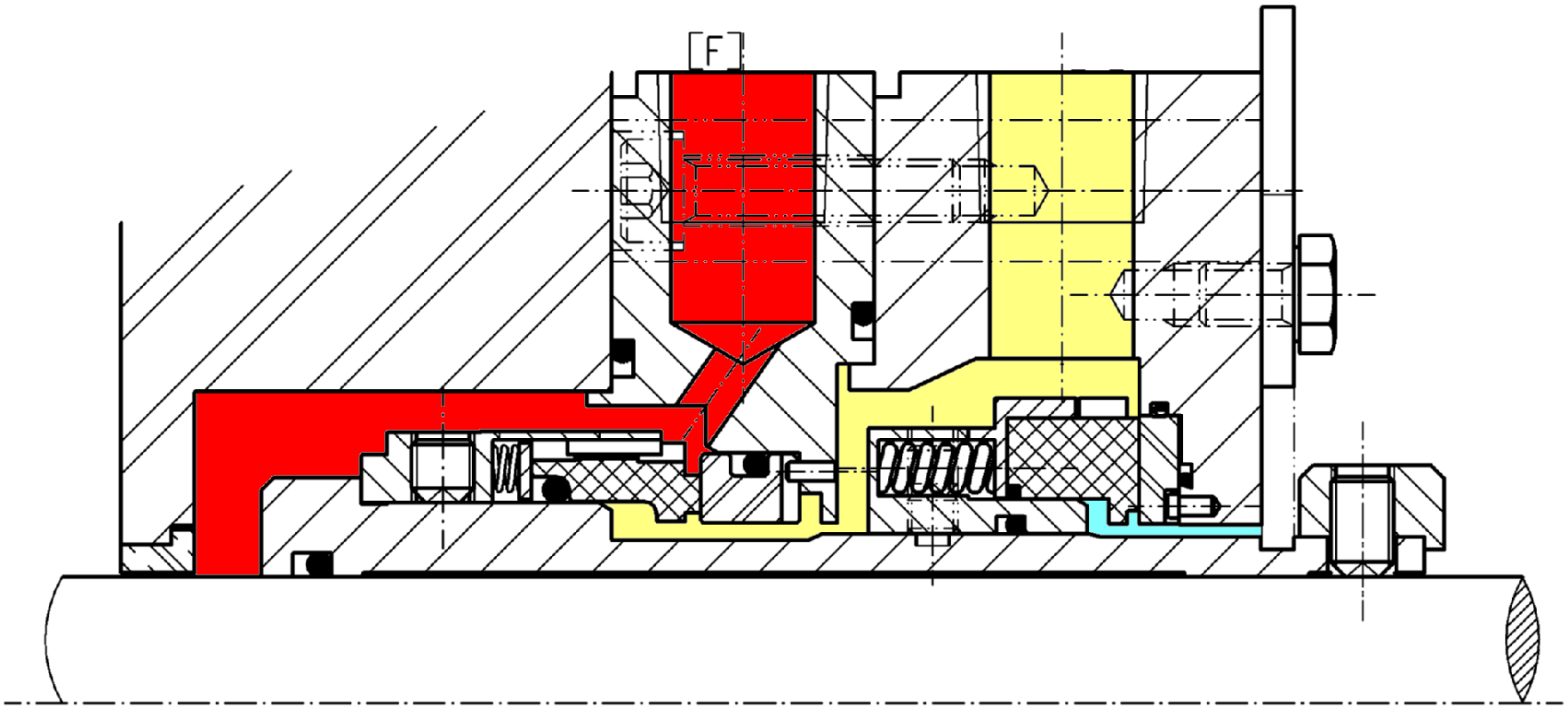
Plan 72



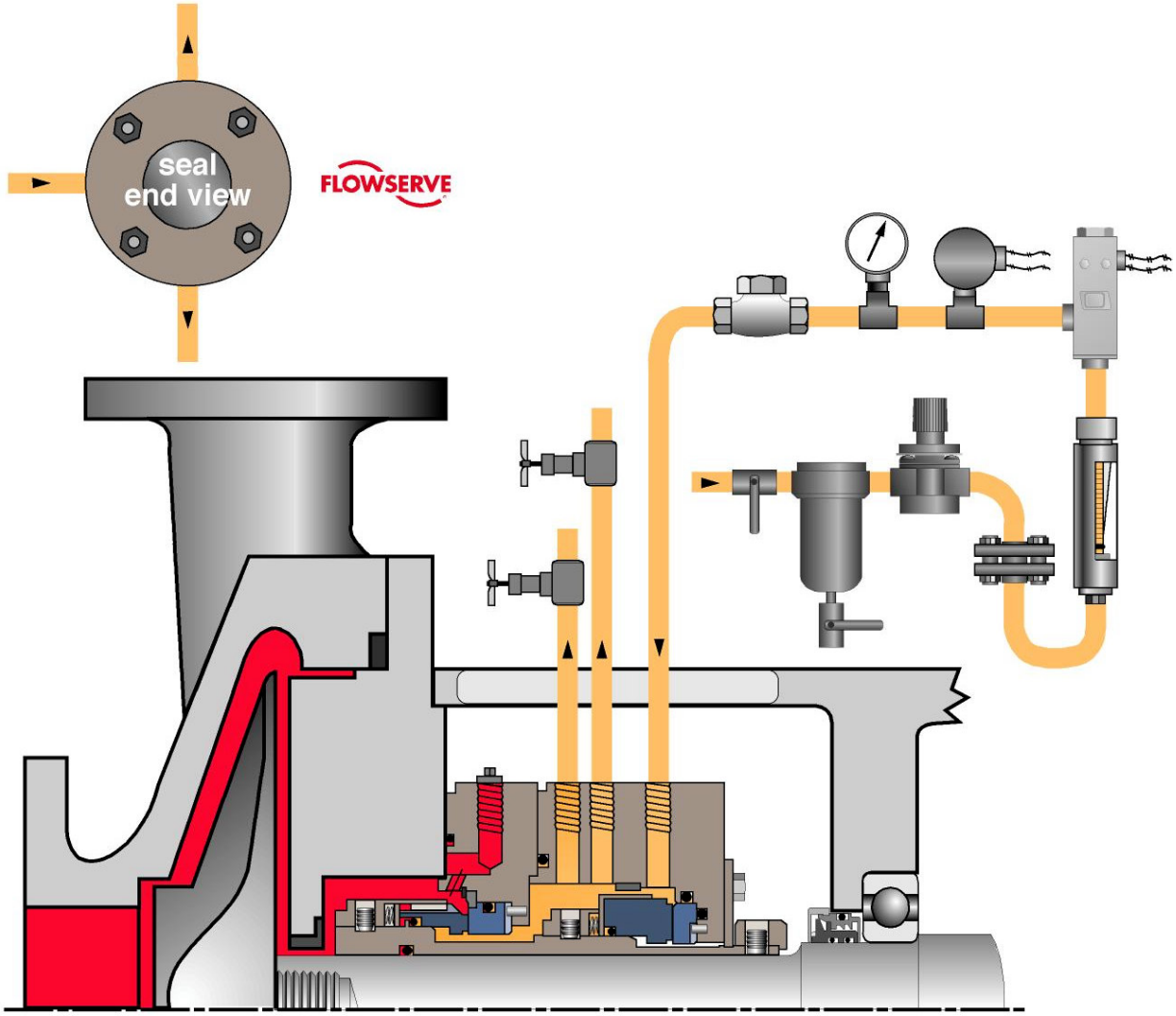
Where

- Used with dual unpressurized containment seals (“tandem”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Clean, non-polymerizing, non-oxidizing fluids.
- Used in combination with Plan 75 and/or Plan 76.

API 682 Type A with Containment
2CW - CS



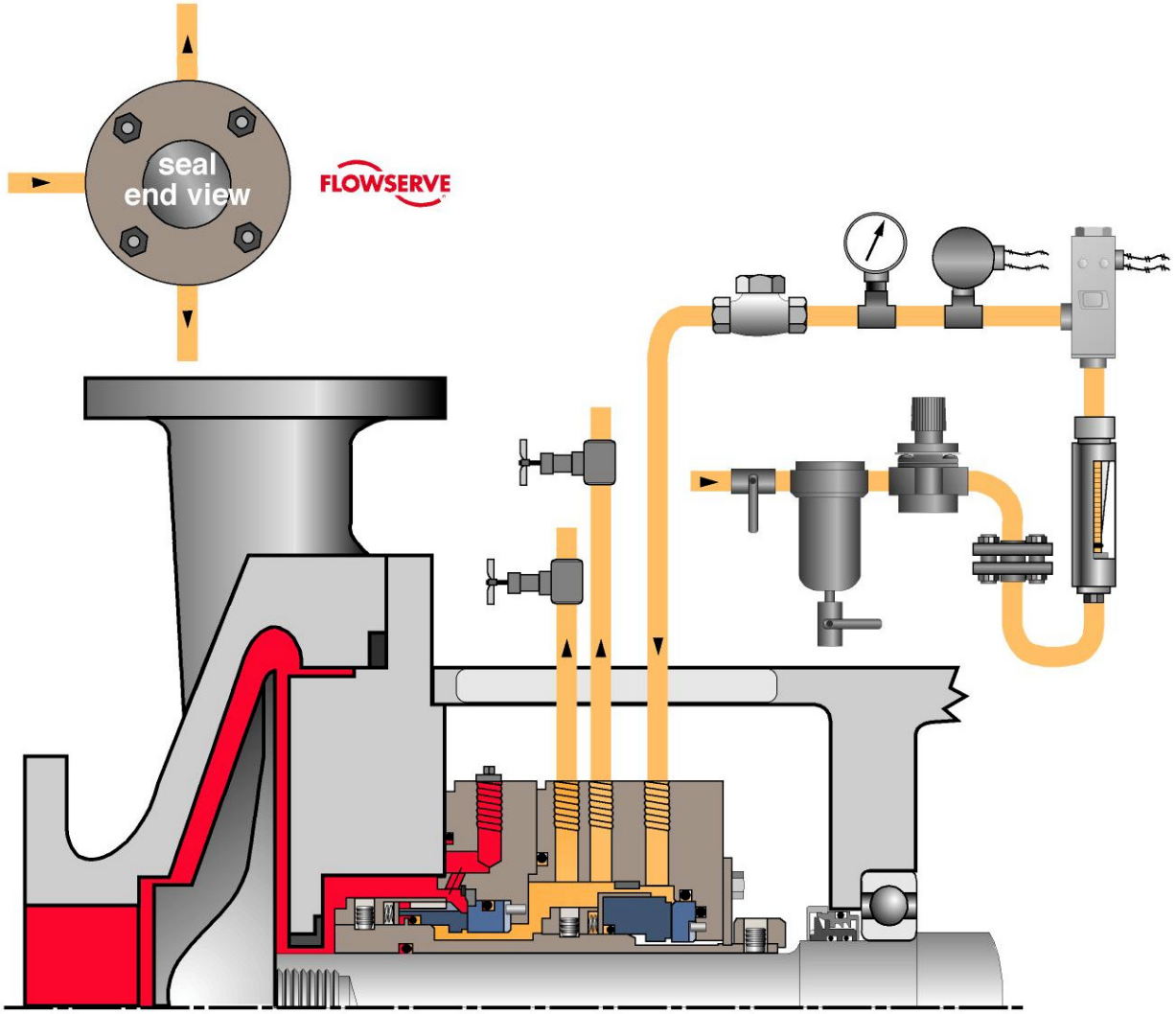
Plan 72



Preventative Maintenance

- Clean, reliable, low pressure gas must be supplied to seal at all times.
- Bottled gas supply is not recommended except as part of an emergency backup system.
- Primary seal leakage is indicated by pressure in the vent line.

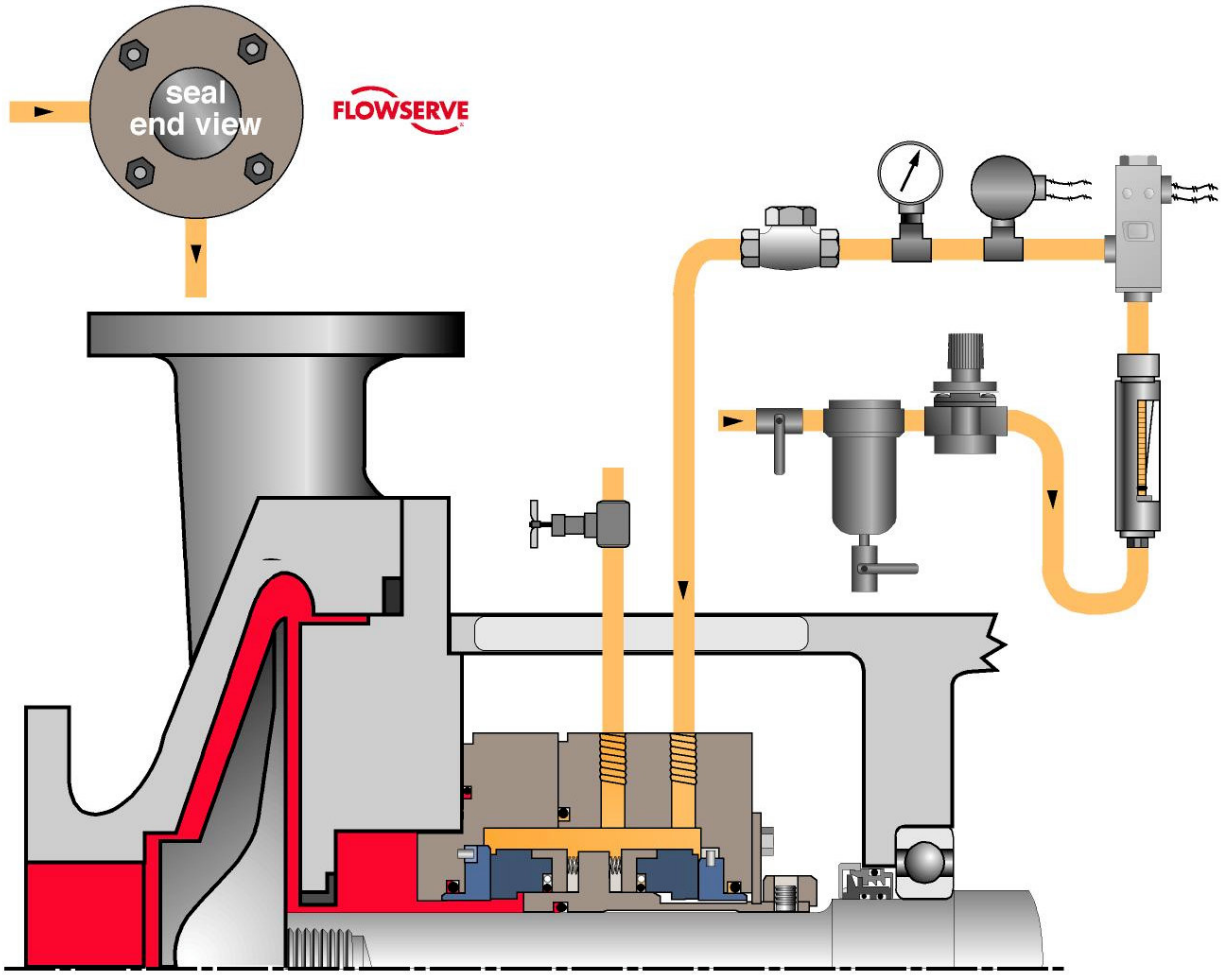
Plan 72



Preventative Maintenance (continued)

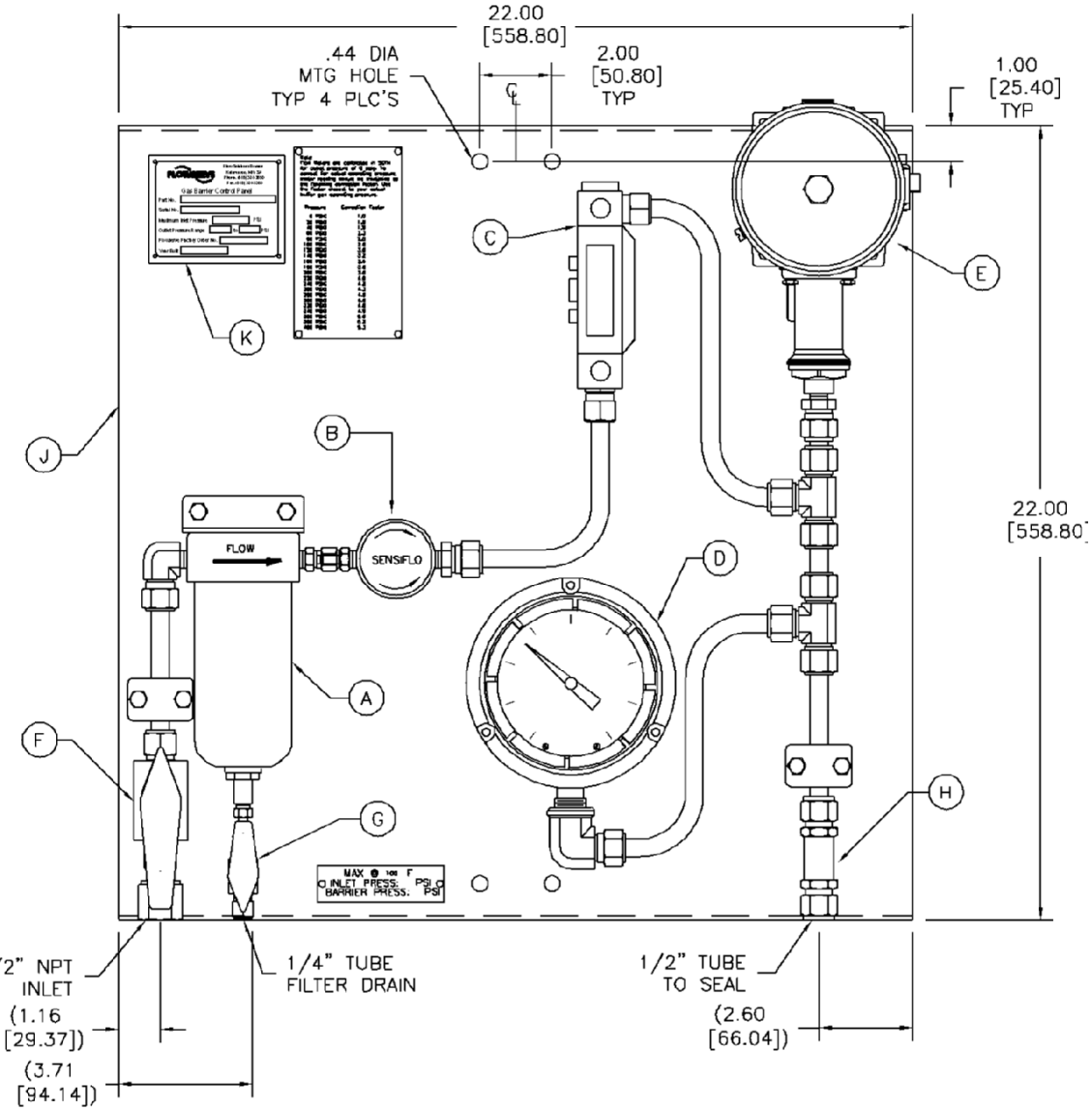
- Vent or drain are usually connected to low pressure vapor recovery/flare system.

Plan 74

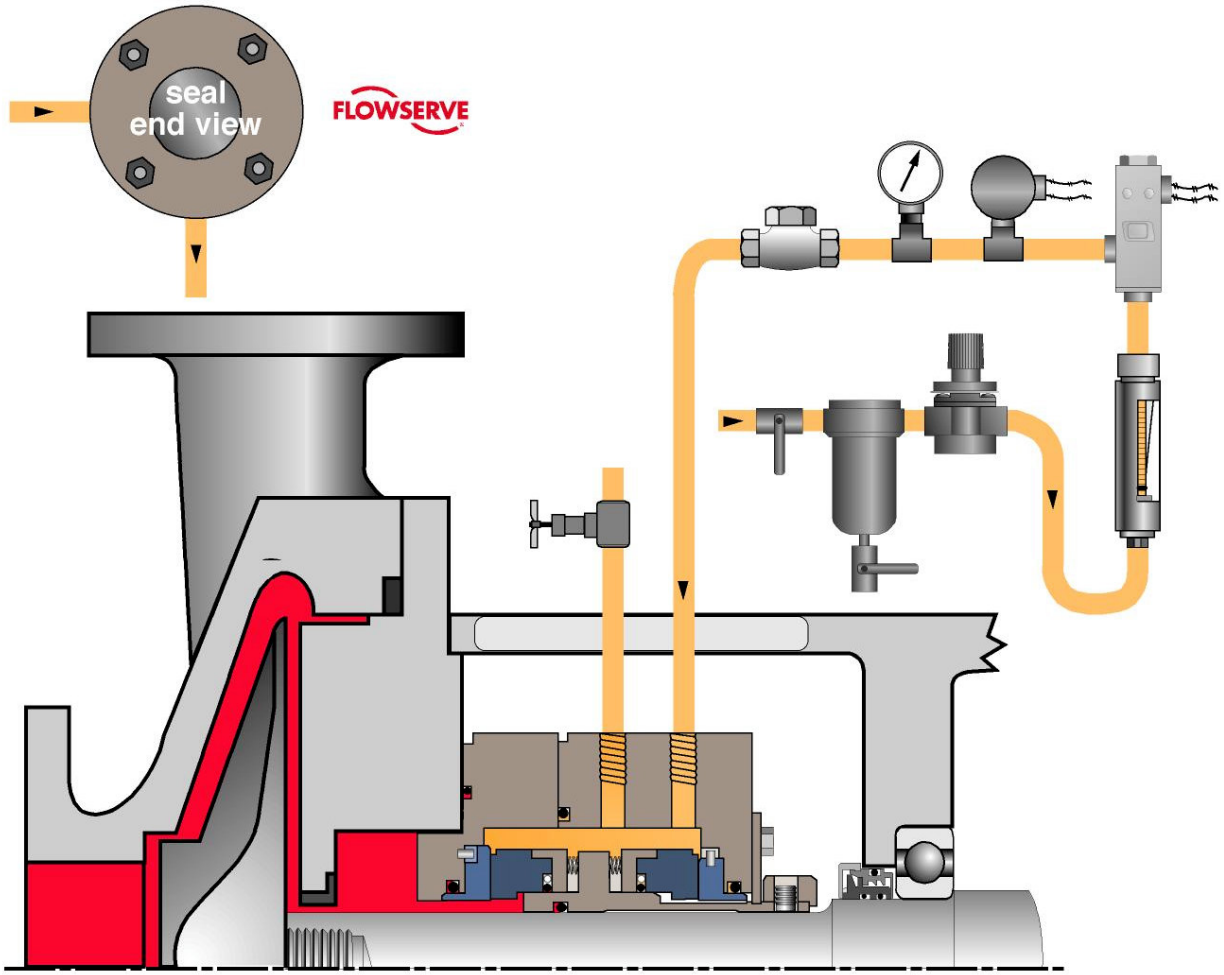


What

- Pressurized barrier gas control system.
- Gas seal support typically with nitrogen barrier gas.


22.00
[558.80]
.44 DIA
MTG HOLE
TYP 4 PLC'S
2.00
[50.80]
TYP
1.00
[25.40]
TYP
22.00
[558.80]
FLOW
SENSIFLO
A
B
C
D
E
F
G
H
J
K
1/2" NPT
INLET
(1.16
[29.37])
(3.71
[94.14])
1/4" TUBE
FILTER DRAIN
1/2" TUBE
TO SEAL
(2.60
[66.04])

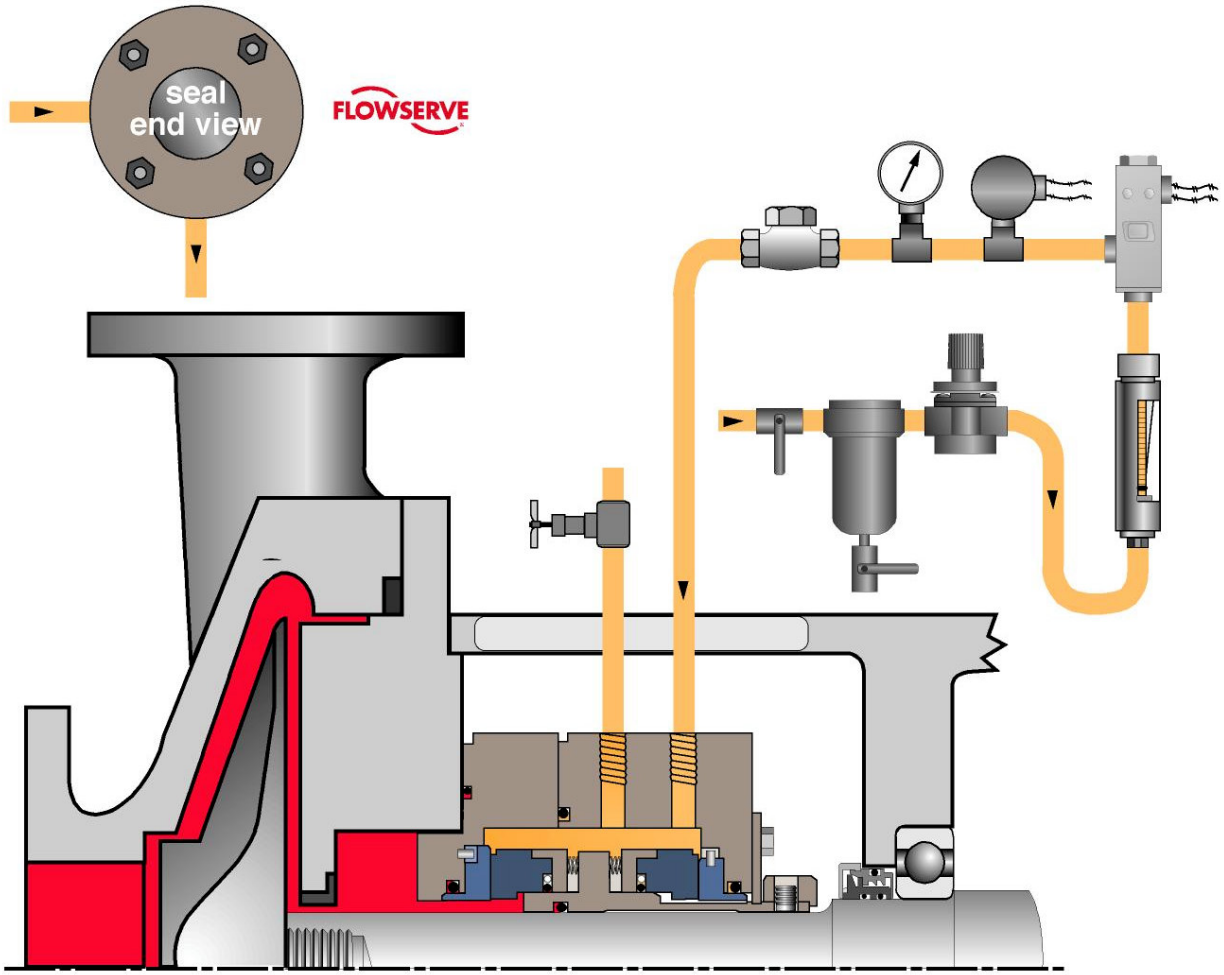
Plan 74



Why

- Isolate process fluid.
- Zero process emissions.

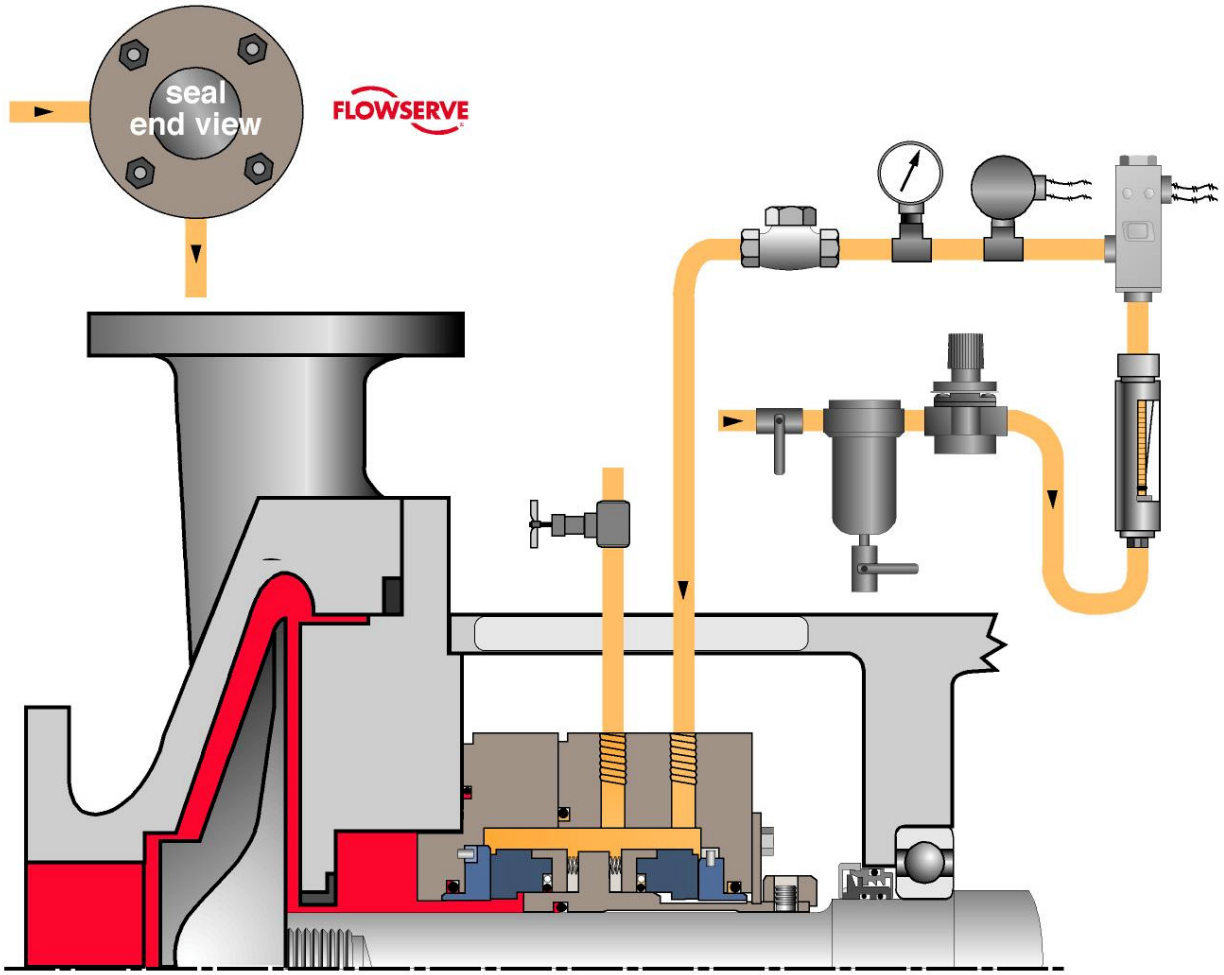
Plan 74



Where

- Used with dual pressurized gas seals (“double”).
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Services that do not tolerate barrier fluids.
- Clean, non-polymerizing fluids.
- Moderate temperature fluids.

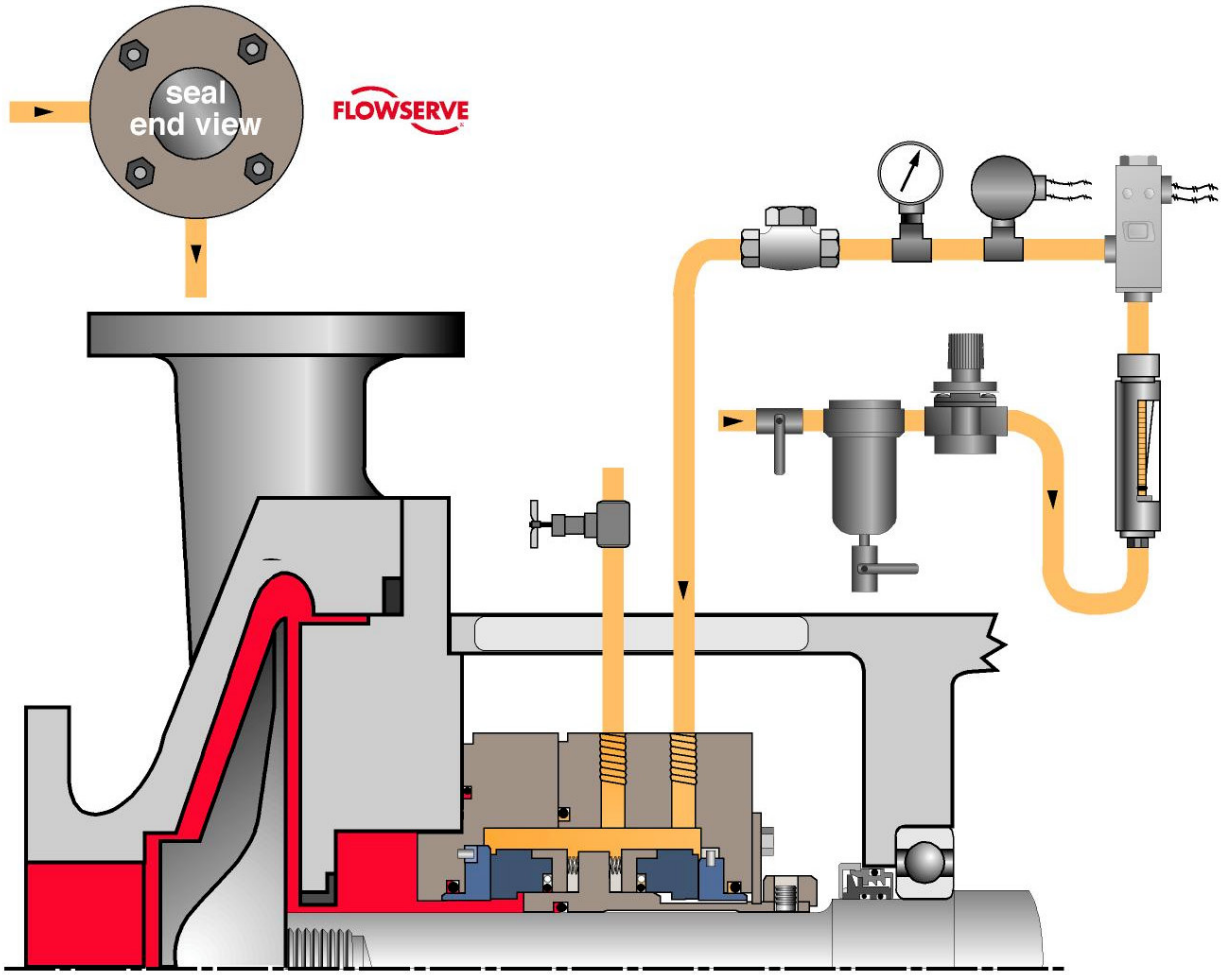
Plan 74



Preventative Maintenance

- Clean, reliable, pressurized gas must be supplied to seal at all times.
- Barrier pressure is typically at least 25 psi (1.75 bar) above seal chamber pressure.
- Flow meter indicates both inboard and outboard seal leakage.

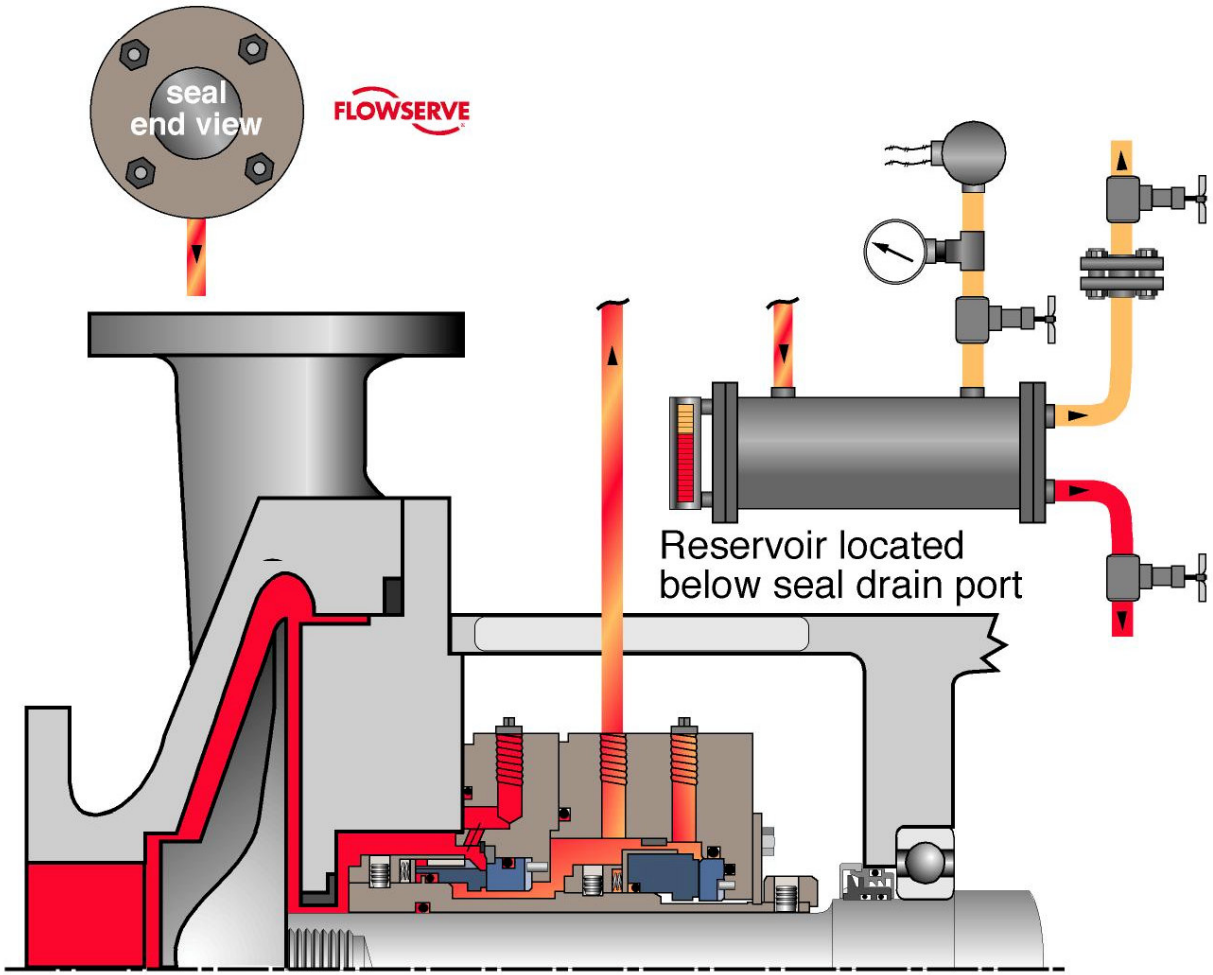
Plan 74



Preventative Maintenance (continued)

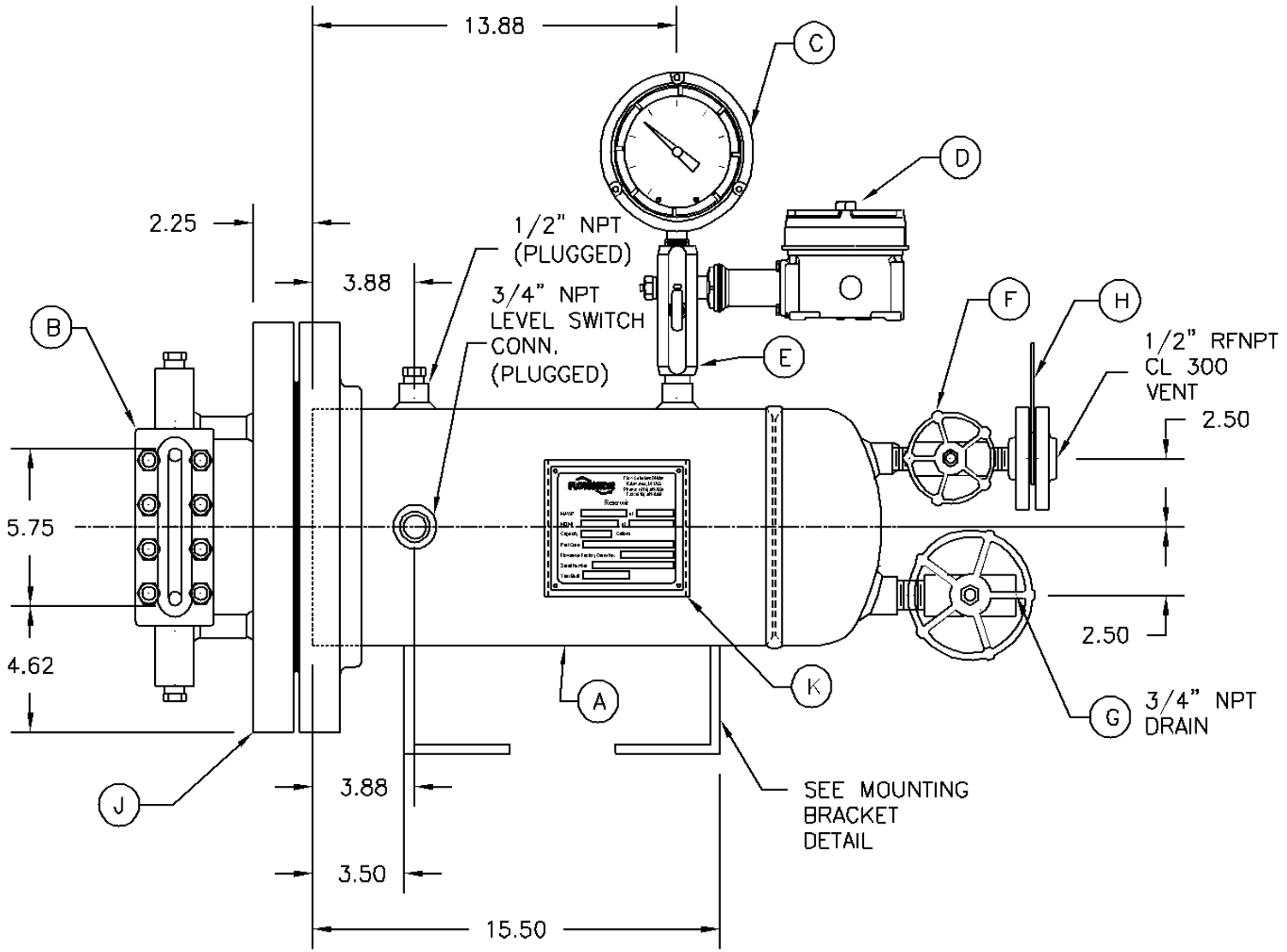
- Bottled gas supply is not recommended except as part of an emergency backup system.

Plan 75

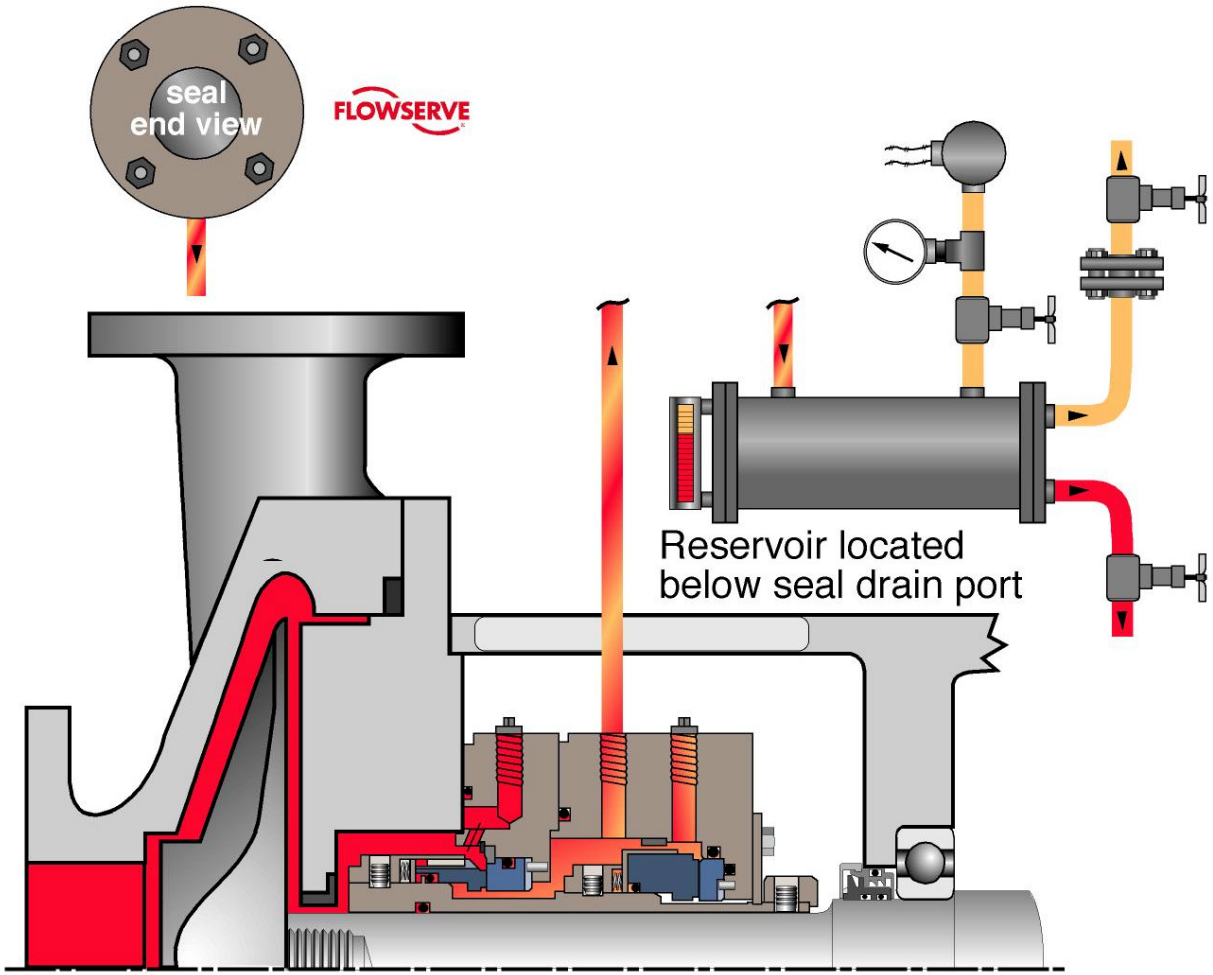


What

- Drain from containment seal cavity to liquid collector and vapor recovery.


13.88
C
D
2.25
1/2" NPT
(PLUGGED)
3.88
3/4" NPT
LEVEL SWITCH
CONN.
(PLUGGED)
B
E
F
H
1/2" RFNPT
CL 300
VENT
2.50
5.75
4.62
2.50
K
A
G
3/4" NPT
DRAIN
J
3.88
SEE MOUNTING
BRACKET
DETAIL
3.50
15.50

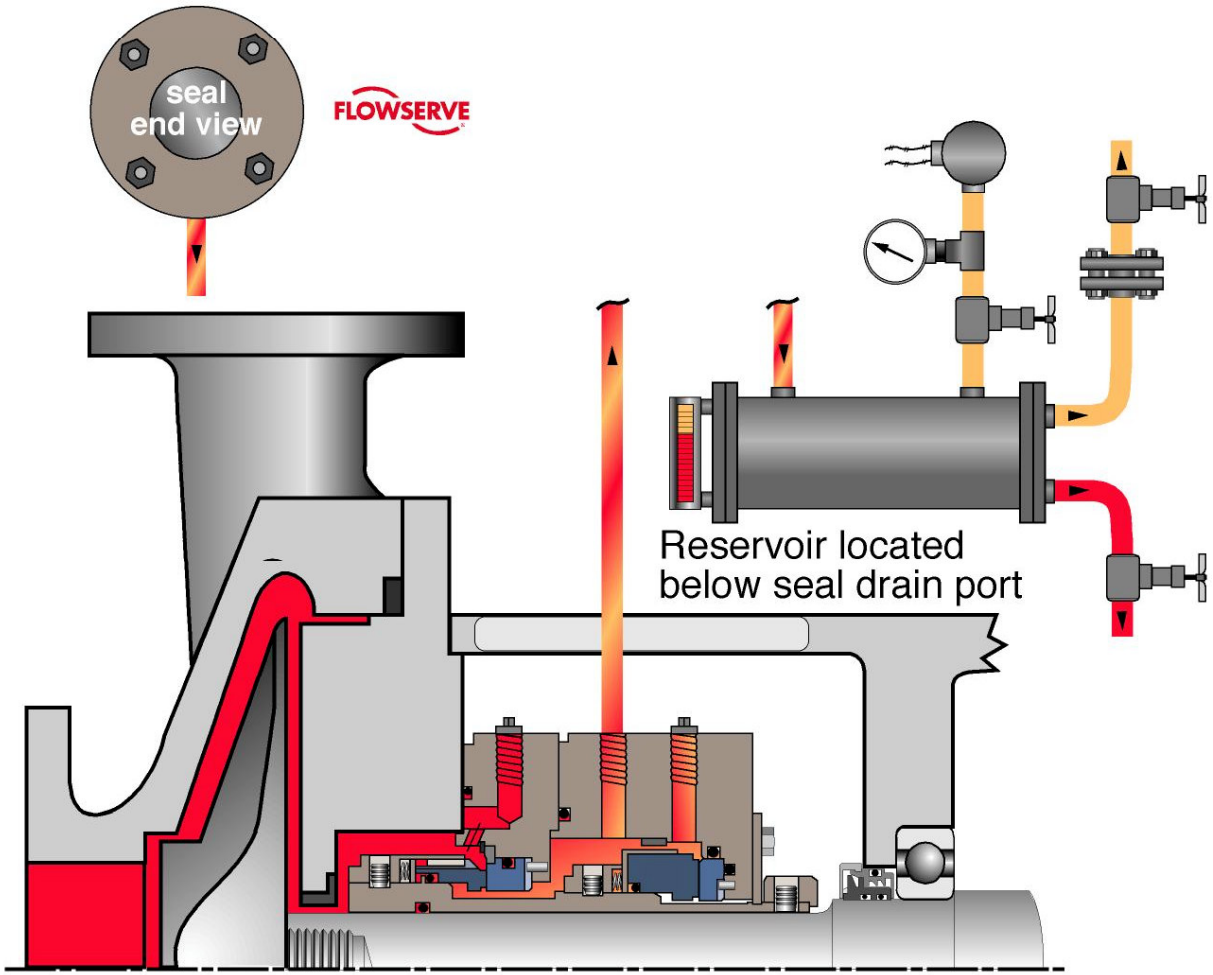
Plan 75



Why

- Leakage collection for zero to very low process emissions.
- Safety indicator for primary seal.

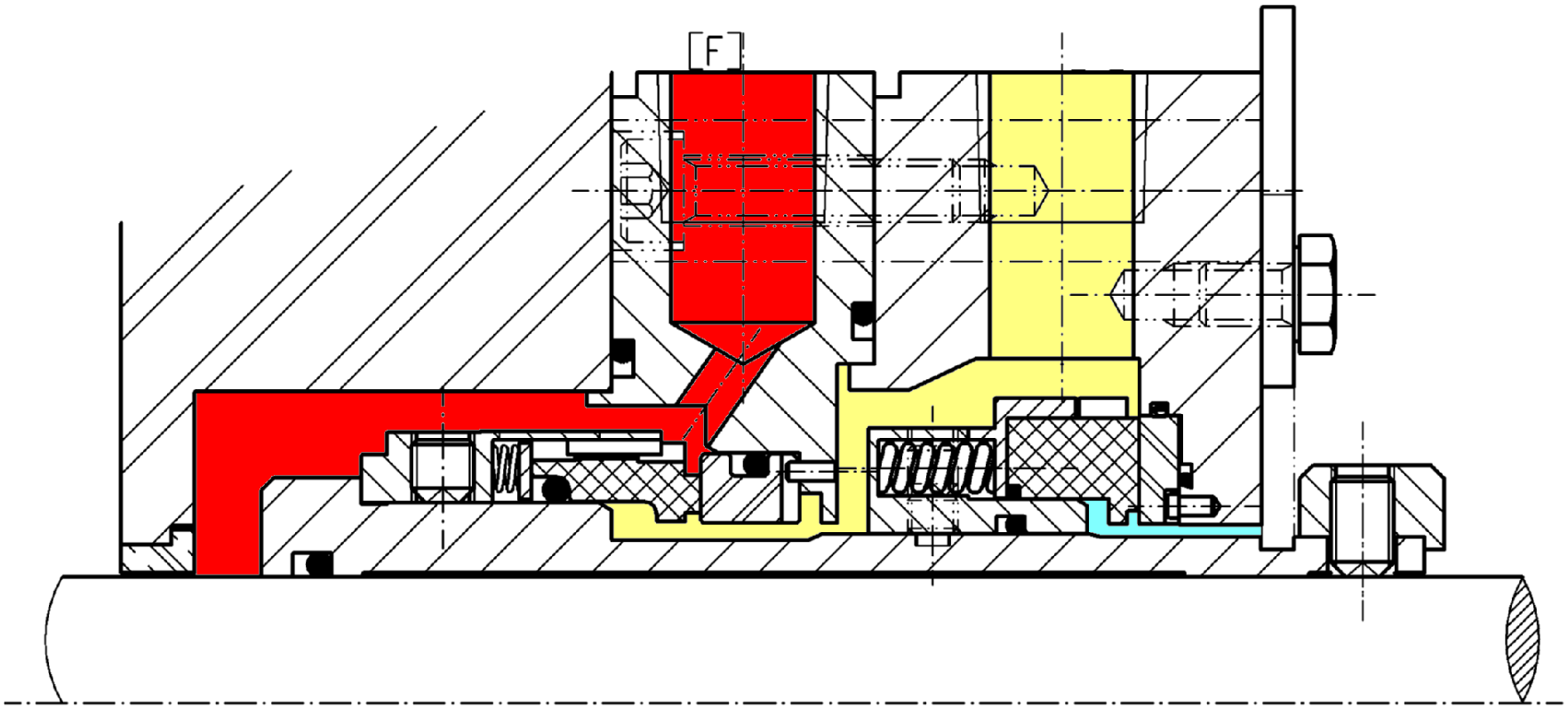
Plan 75



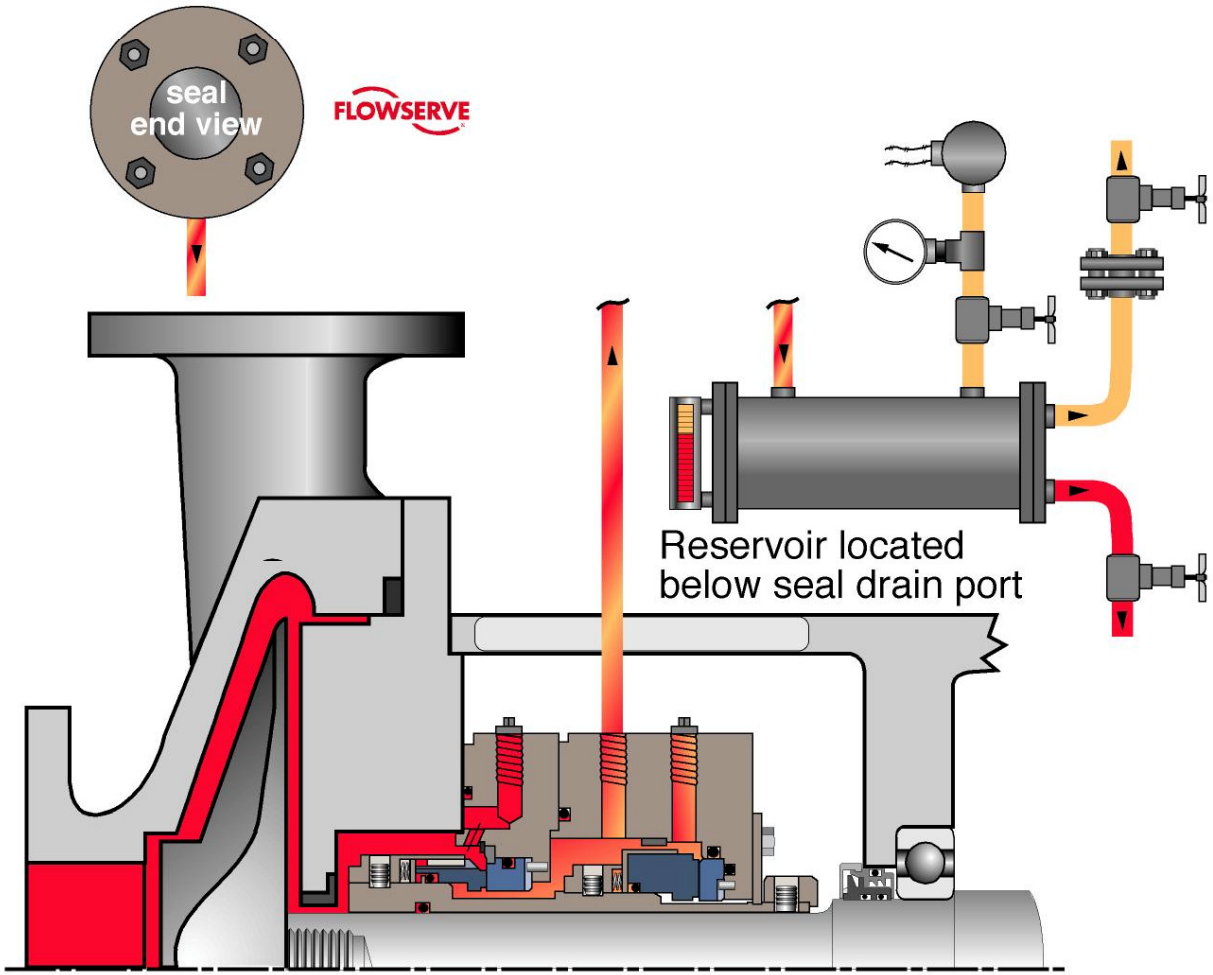
Where

- May be used alone or with Plan 72 on containment seals.
- Fluids that condense at ambient temperature.
- High pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Clean, non-polymerizing, non-oxidizing fluids.

API 682 Type A with Containment
2CW - CS



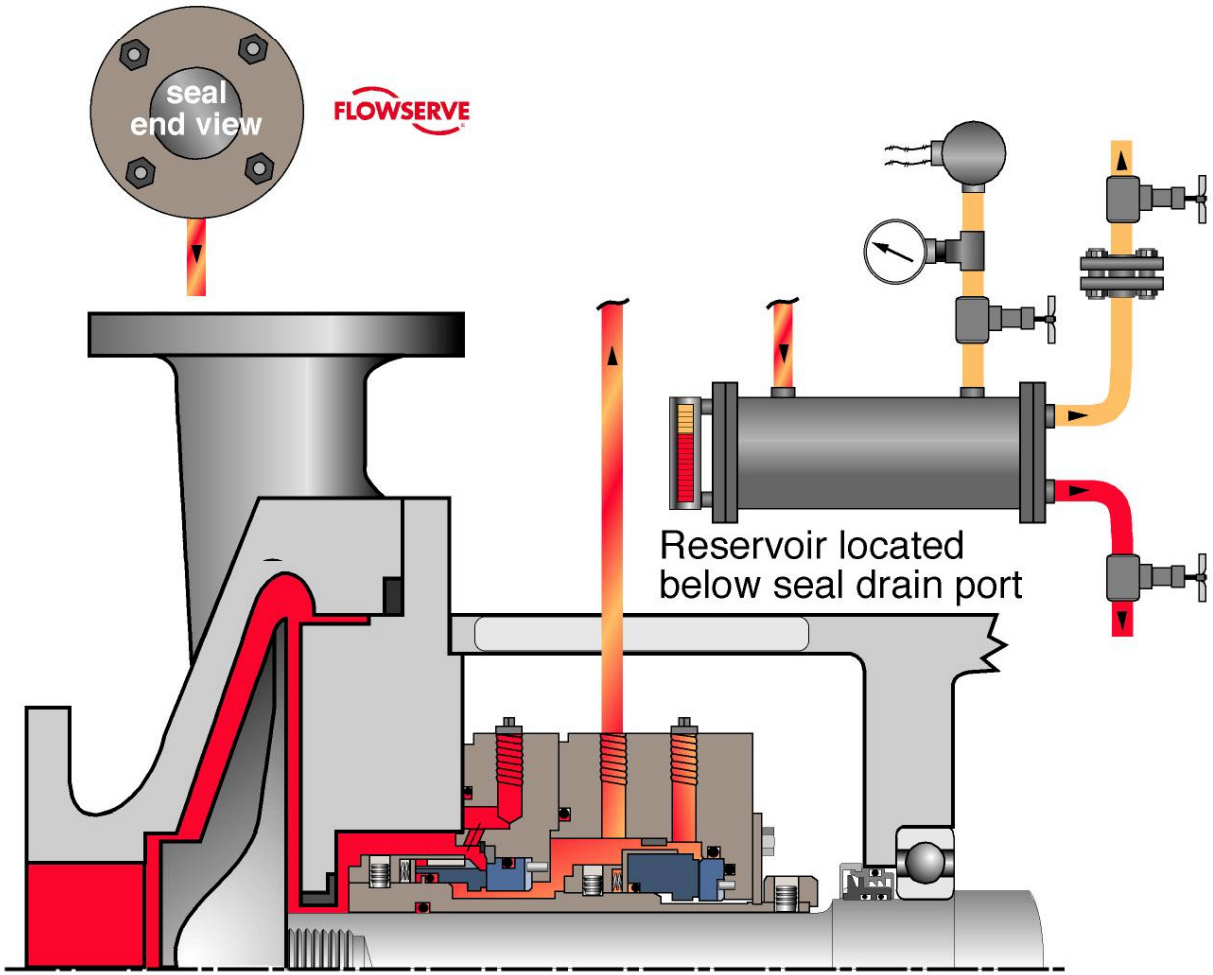
Plan 75



Preventative Maintenance

- Collection reservoir must be located below seal drain and downward-sloped piping.
- Continuously vent collection reservoir to low pressure vapor recovery/flare system.
- Drain collection reservoir to liquid recovery system as needed.

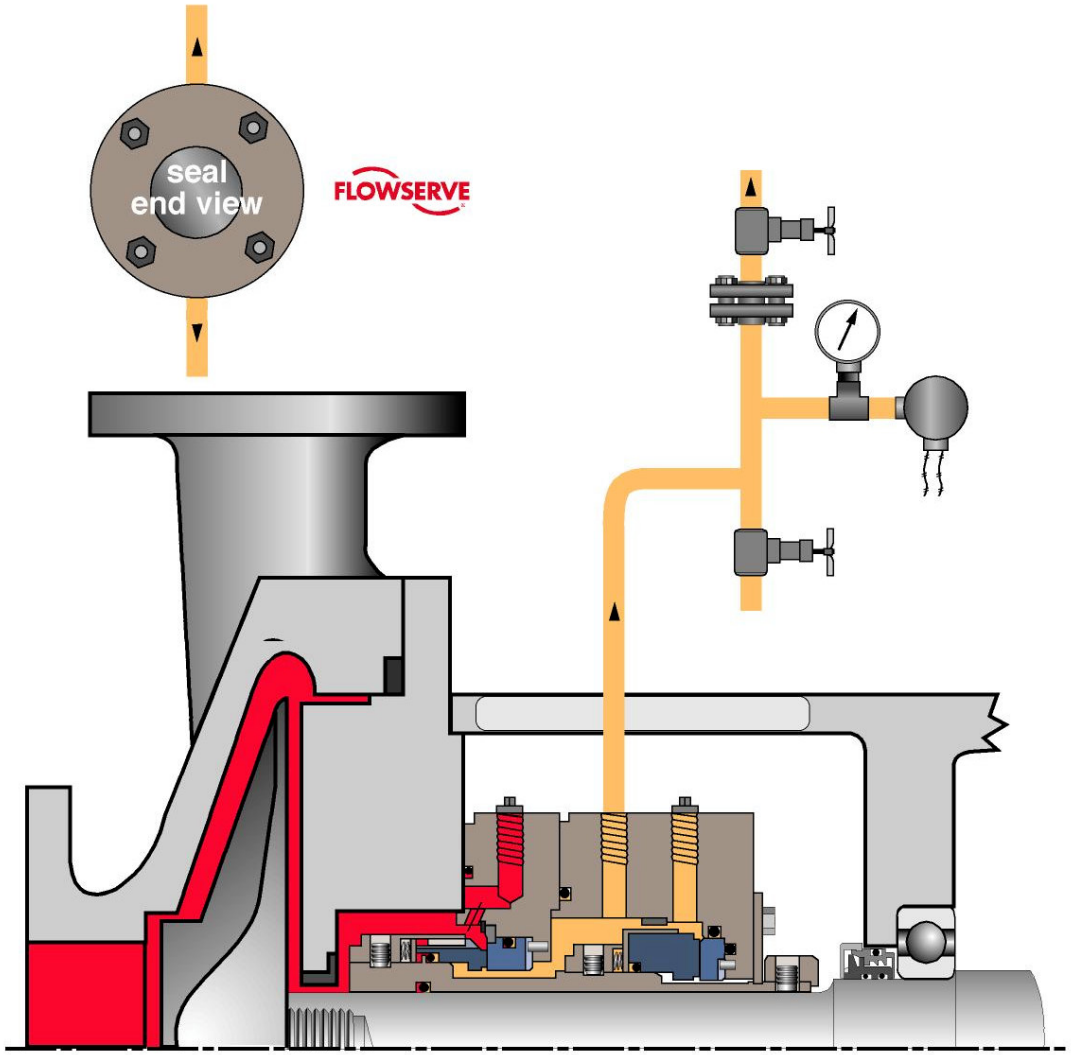
Plan 75



Preventative Maintenance (continued)

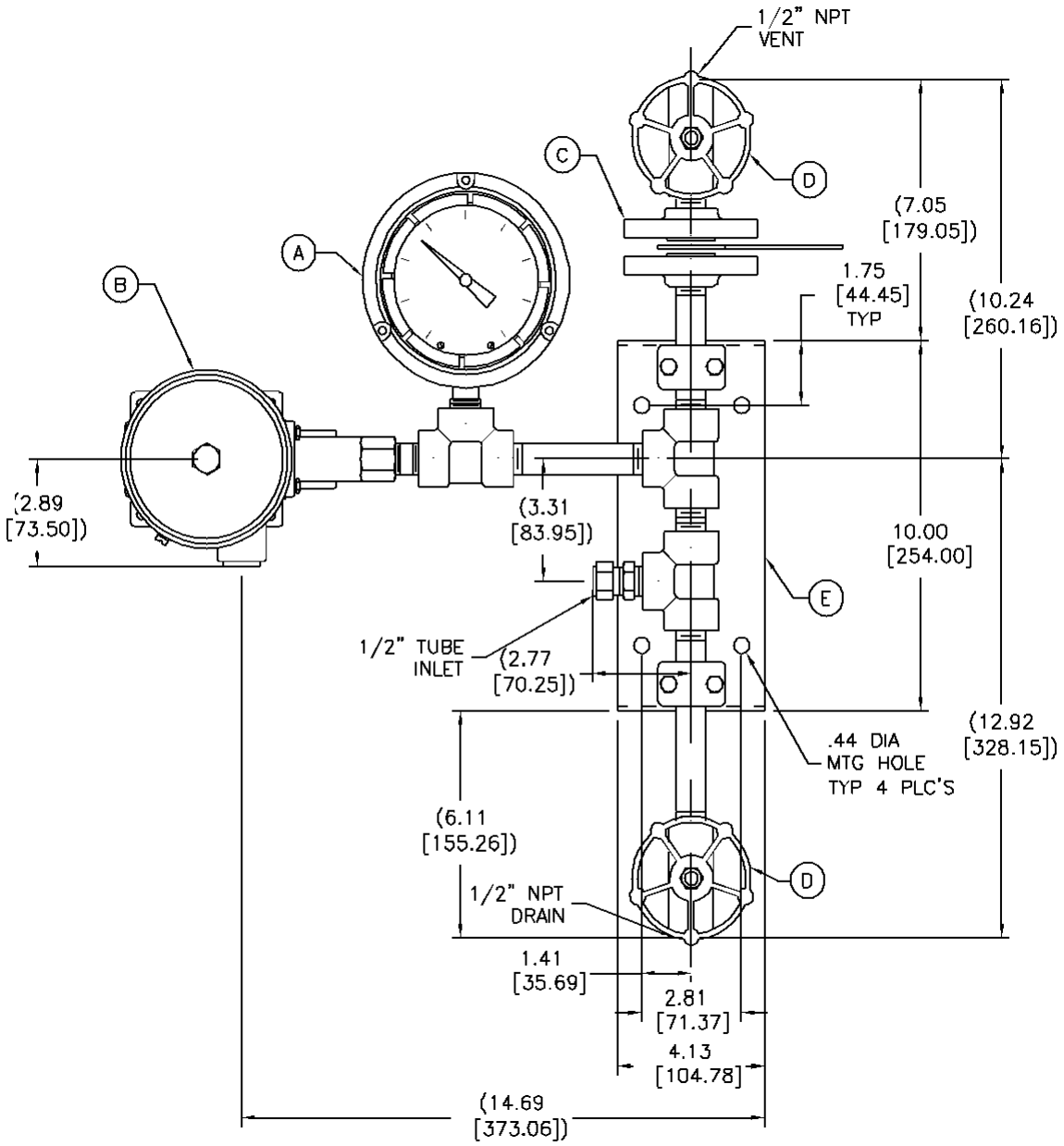
- Primary seal leakage is indicated by increased vent pressure.
- Monitor regularly for liquid level, valve settings, and low vent pressure.

Plan 76

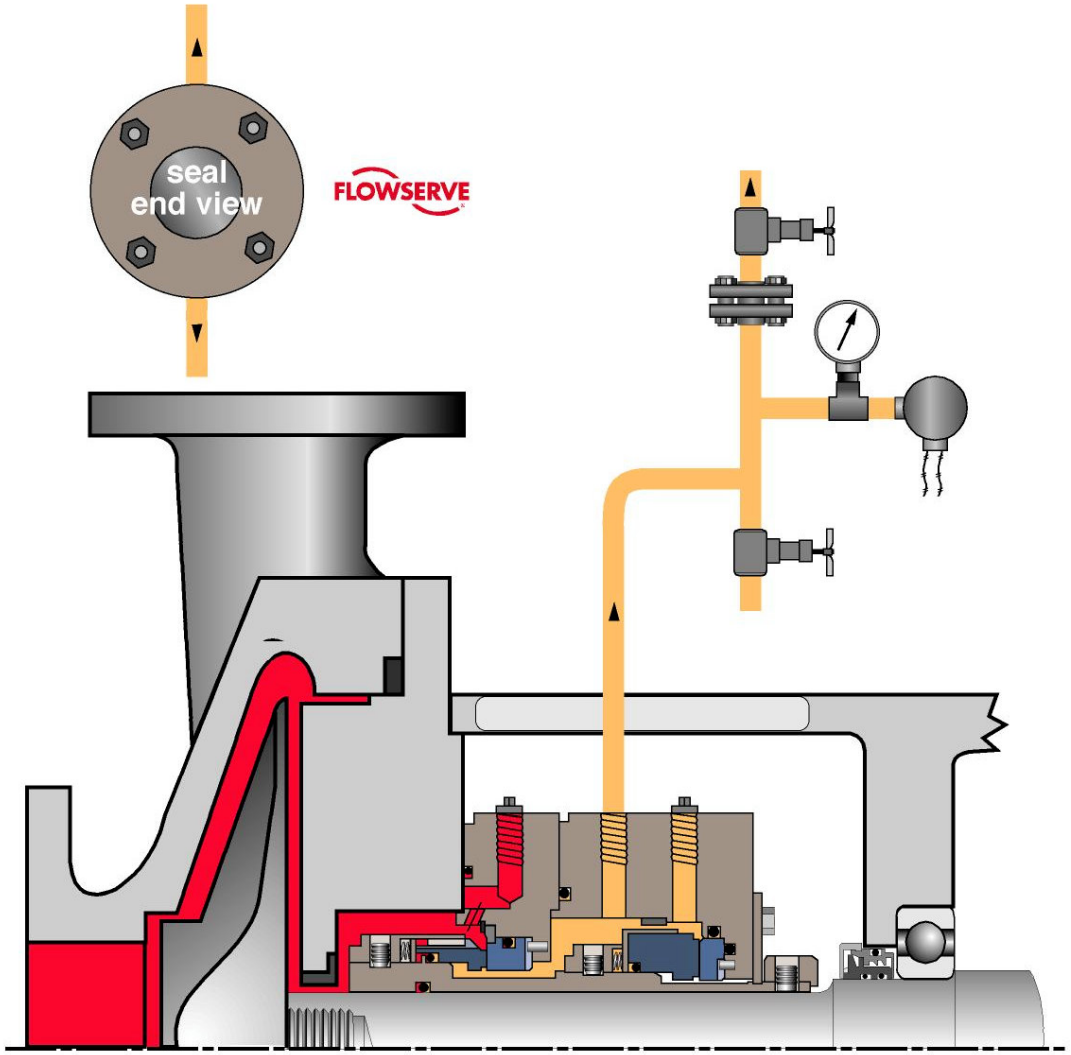


What

- Vent from containment seal cavity to vapor recovery.


1/2" NPT
VENT
C
D
A
B
(7.05
[179.05])
1.75
[44.45]
TYP
(10.24
[260.16])
(2.89
[73.50])
(3.31
[83.95])
10.00
[254.00]
E
1/2" TUBE
INLET
(2.77
[70.25])
.44 DIA
MTG HOLE
TYP 4 PLC'S
(12.92
[328.15])
(6.11
[155.26])
D
1/2" NPT
DRAIN
1.41
[35.69]
2.81
[71.37]
4.13
[104.78]
(14.69
[373.06])

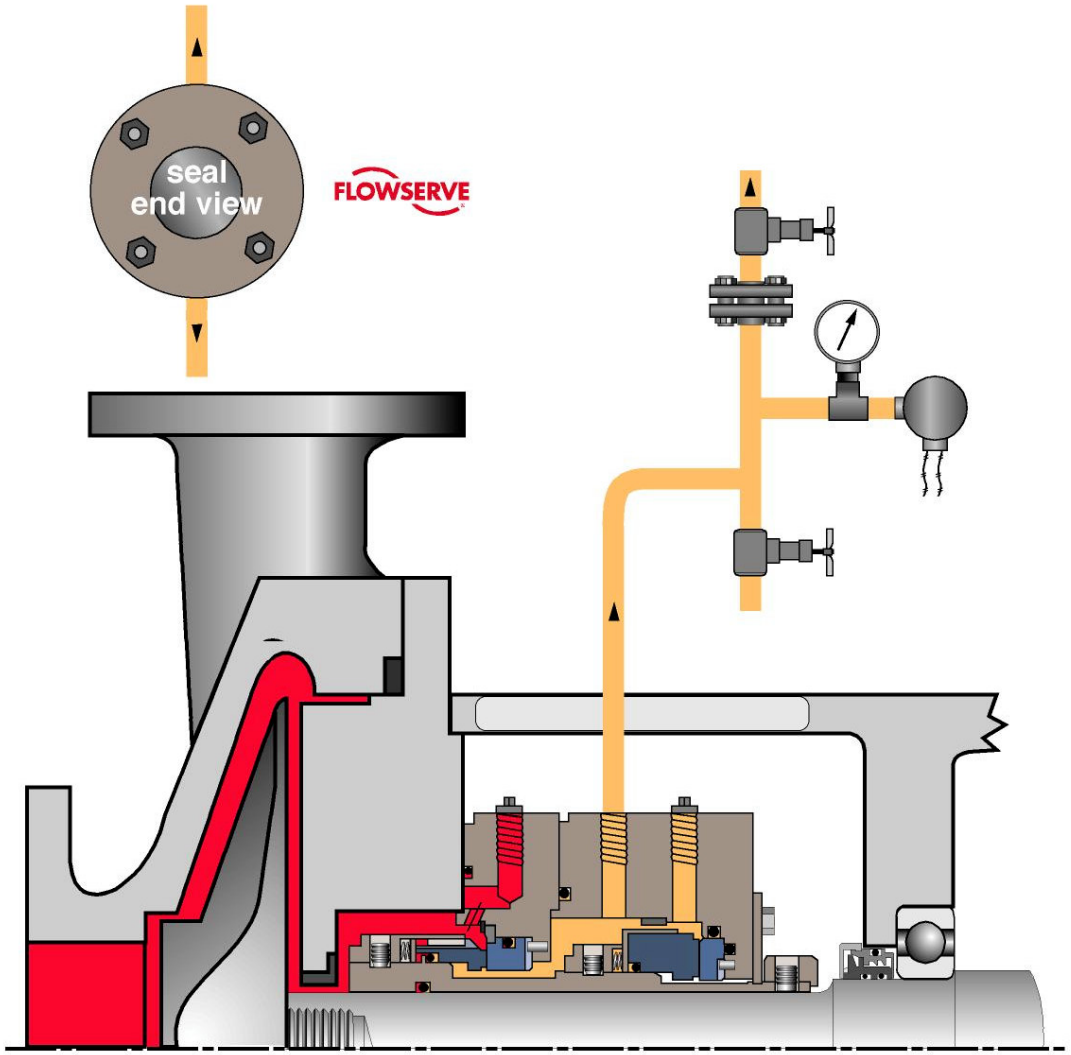
Plan 76



Why

- Leakage collection for zero to very low process emissions.
- Safety indicator for primary seal.

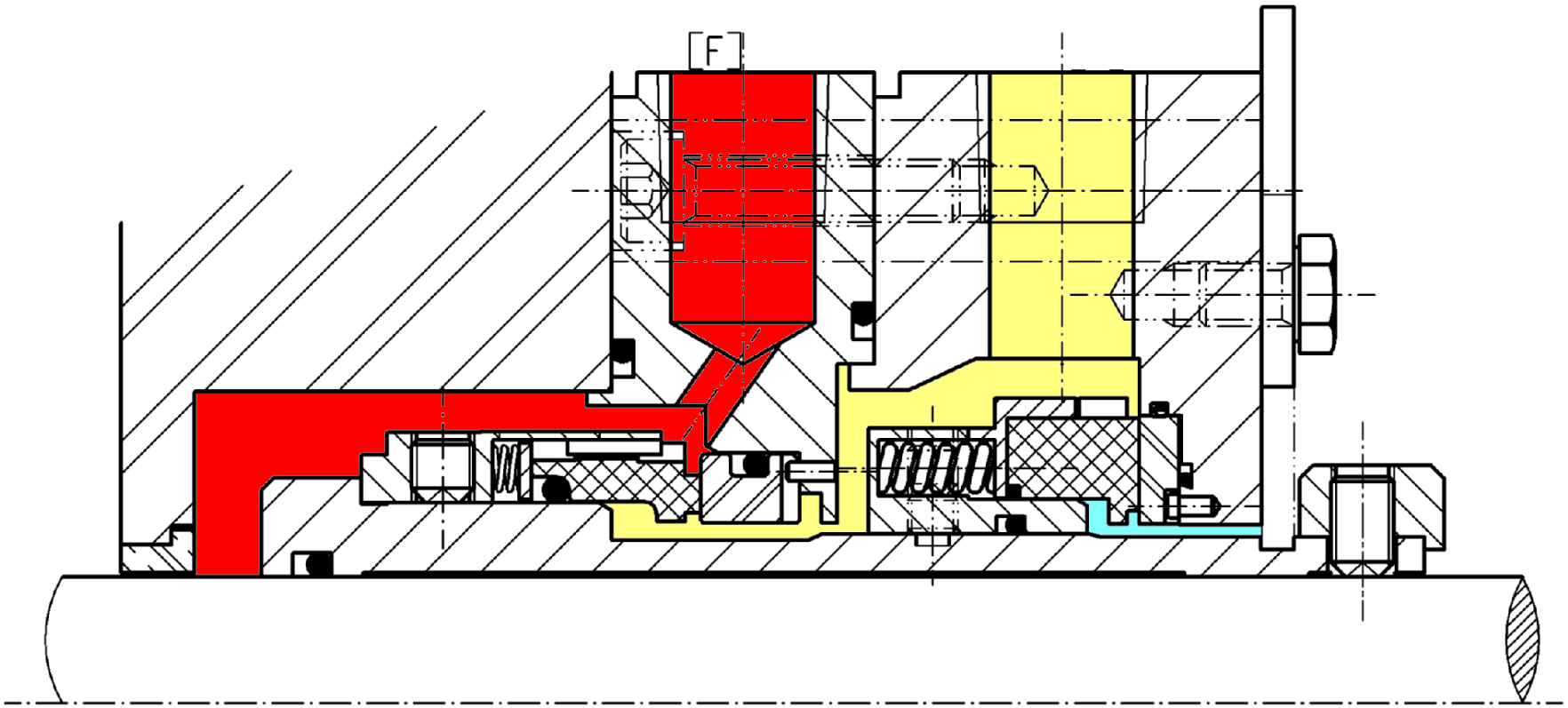
Plan 76



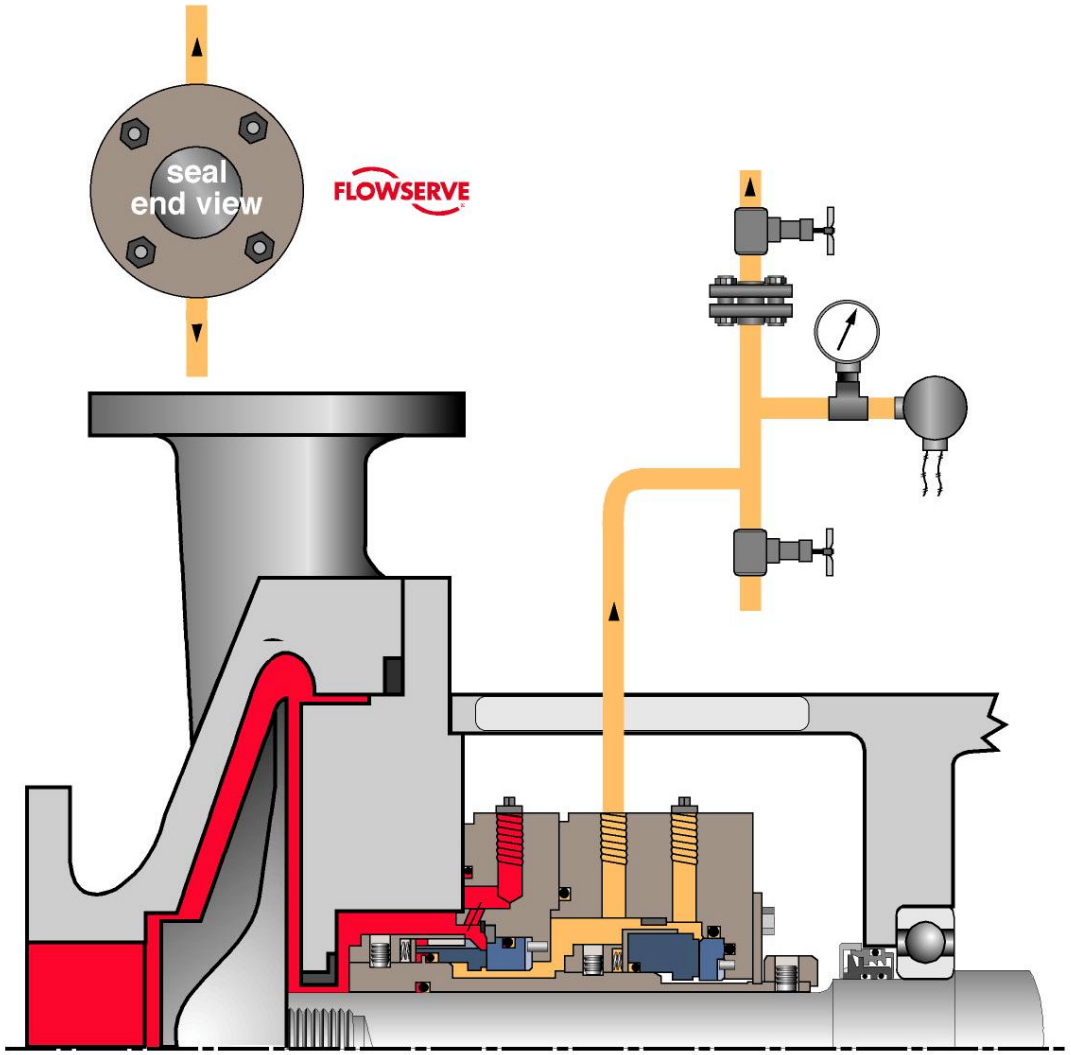
Where

- May be used alone or with Plan 72 on containment seals.
- Fluids that do not condense at ambient temperature.
- High vapor pressure fluids, light hydrocarbons.
- Hazardous or toxic fluids.
- Clean, non-polymerizing, non-oxidizing fluids.

API 682 Type A with Containment
2CW - CS



Plan 76

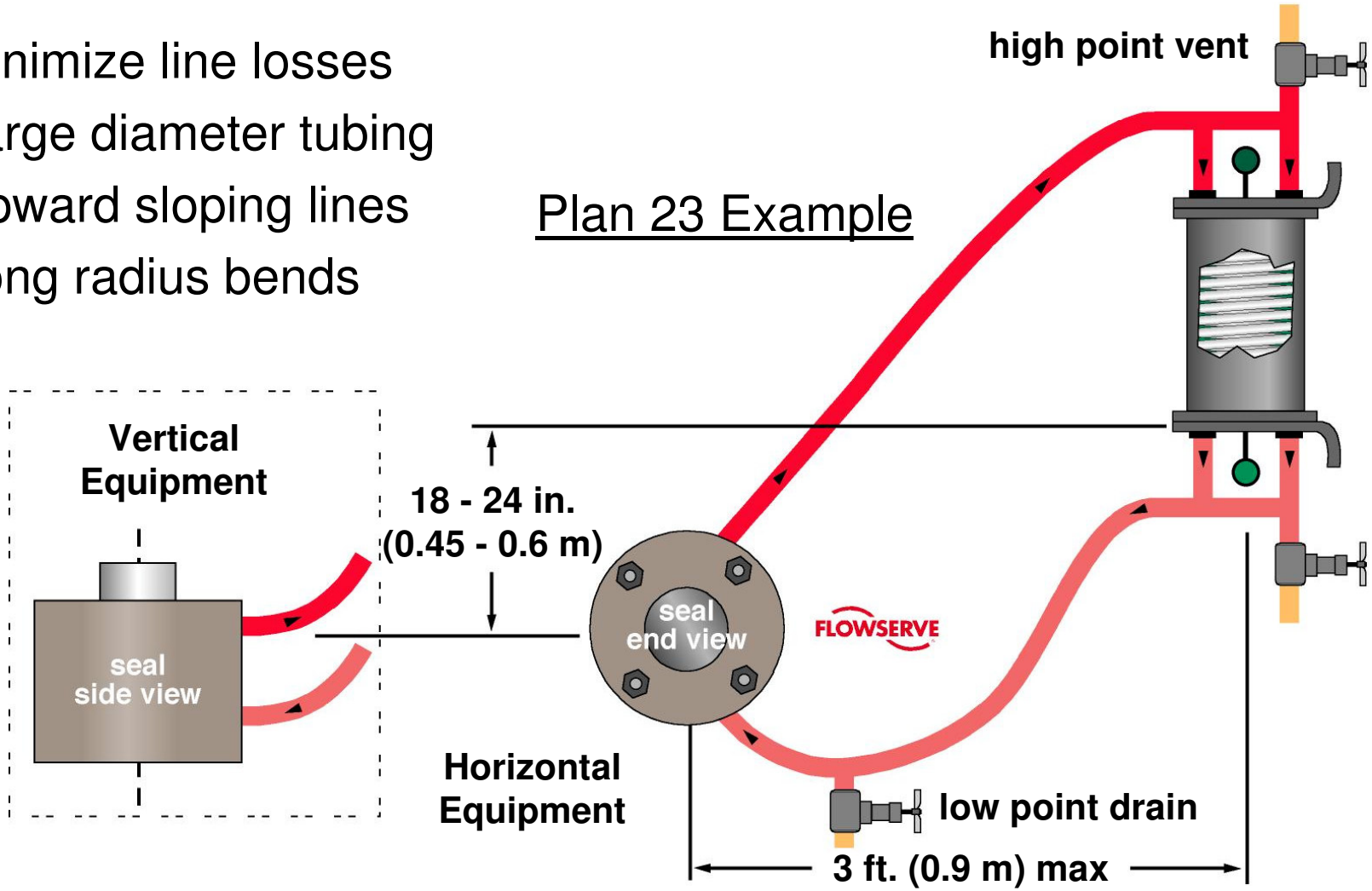


Preventative Maintenance

- Continuously vent to low pressure vapor recovery/flare system.
- Vent piping should include a condensate drain.
- Primary seal leakage is detected by increased vent pressure.
- Monitor regularly for valve settings, blocked lines, and low vent pressure.

Good Piping Practices

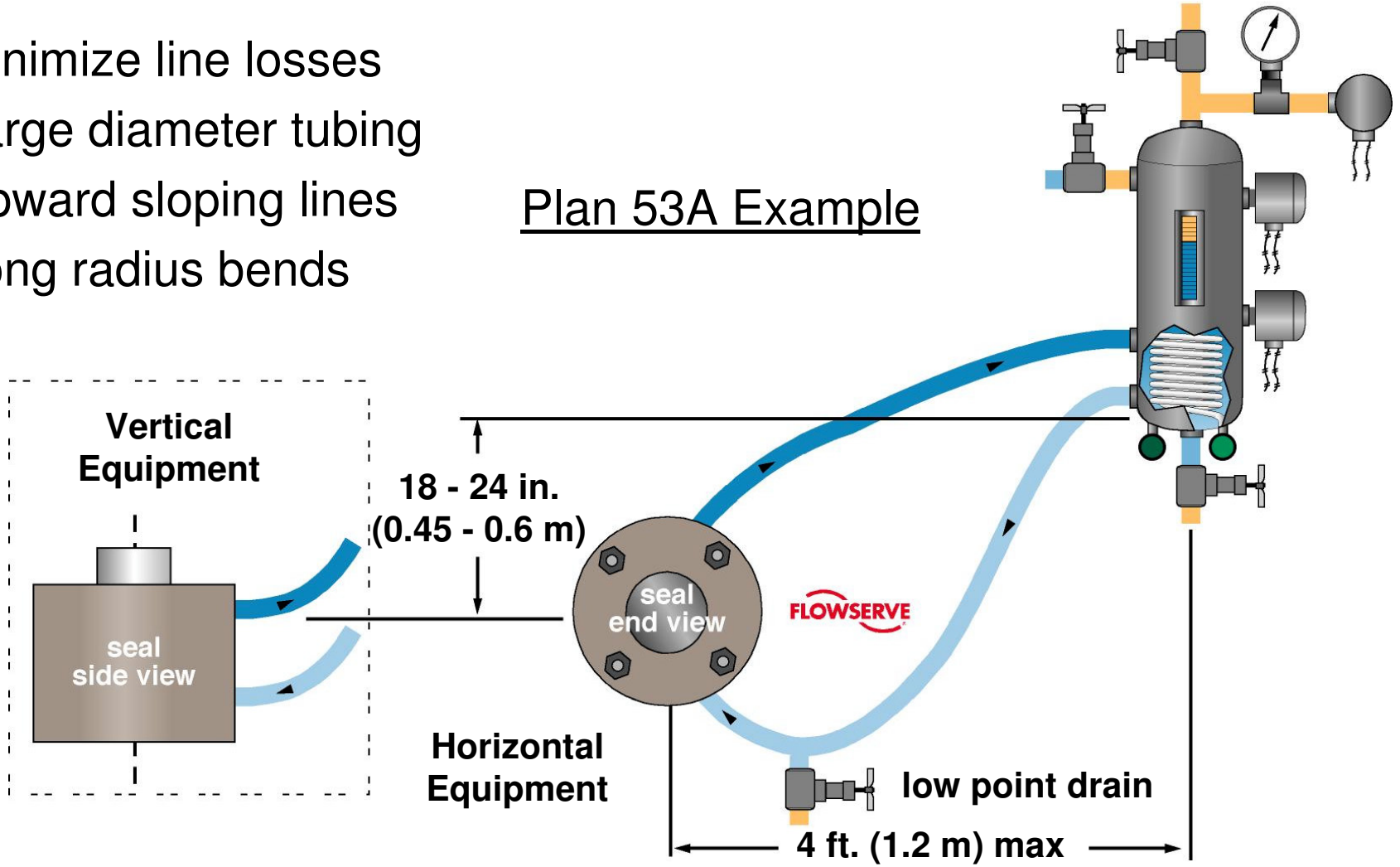
- ☑ Minimize line losses
- ☑ Large diameter tubing
- ☑ Upward sloping lines
- ☑ Long radius bends



Good Piping Practices

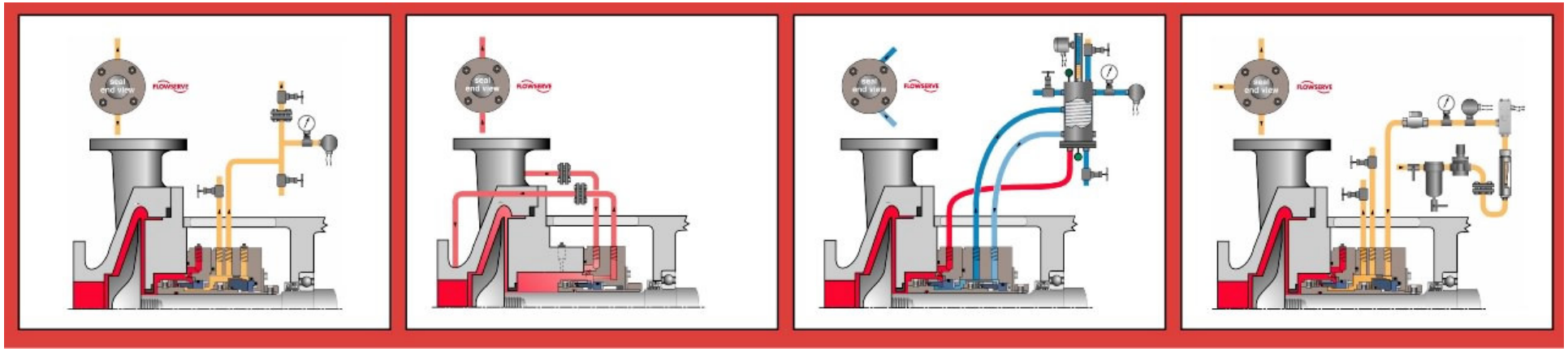
- ☑ Minimize line losses
- ☑ Large diameter tubing
- ☑ Upward sloping lines
- ☑ Long radius bends

Plan 53A Example



Review

- Intended to create a more favorable environment for the seal
- Collect and detect seal leakage and provide safety backup
- Documented in several API, ASME, and ISO standards
- May require auxiliary equipment or external sources of fluids
- Necessary to improve seal reliability/Safety



Questions?