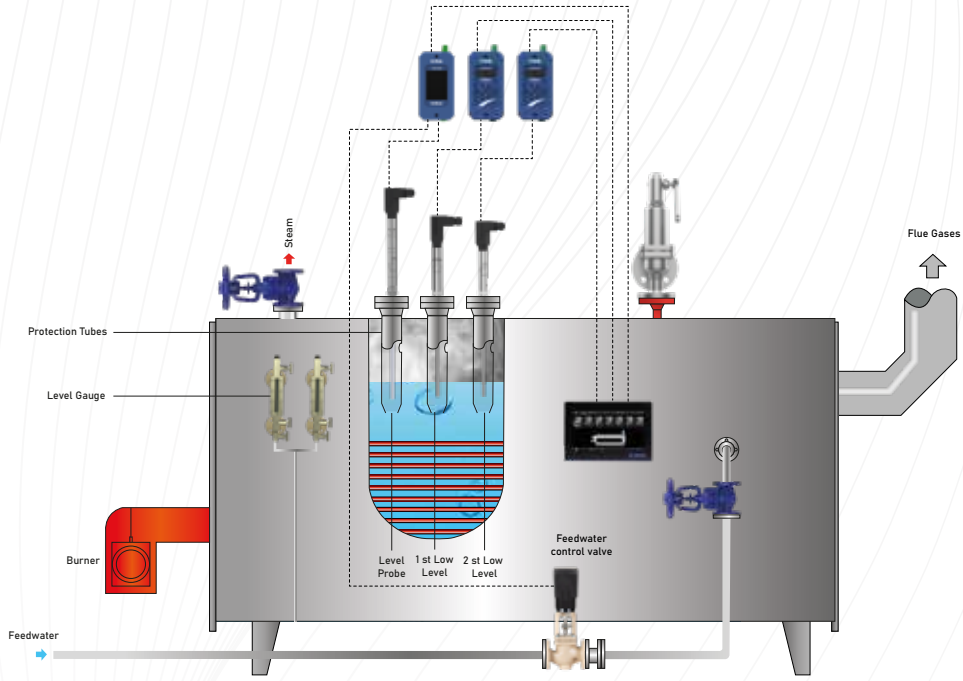
Boiler Level Control and Safety

In steam boilers, the water level decreases with the convert of the water into steam and the decreasing water is completed by the operation of the boiler feedwater pump. Depending on the amount of steam produced in the steam boiler, since the water temperature entering the boiler is lower than the boiler temperature and due to changes in steam pressure, a constant fluctuation in the water level occurs. For the efficient and safe operation of boilers, the water level must always be checked. This check may include a sound or light alarm, shutting down the feedwater supply, and shutting down the burner. It is also essential to provide an outside drum level indicator such as magnetic or reflex level gauges.



Note: Level probes can be both installed in a protection tube or a level tube. It is undesirable for the water to drop below the desired level in steam boilers. If it does, it can cause costly damage to the boilers and even fatal accidents. In case of low water level, check the following reasons.

Causes of Low Level
- Lack of feedwater
- Sudden load changes
- Feedwater pump failure
- Safety valve leaks
- Control valve malfunction
- Malfunction of boiler water level controller

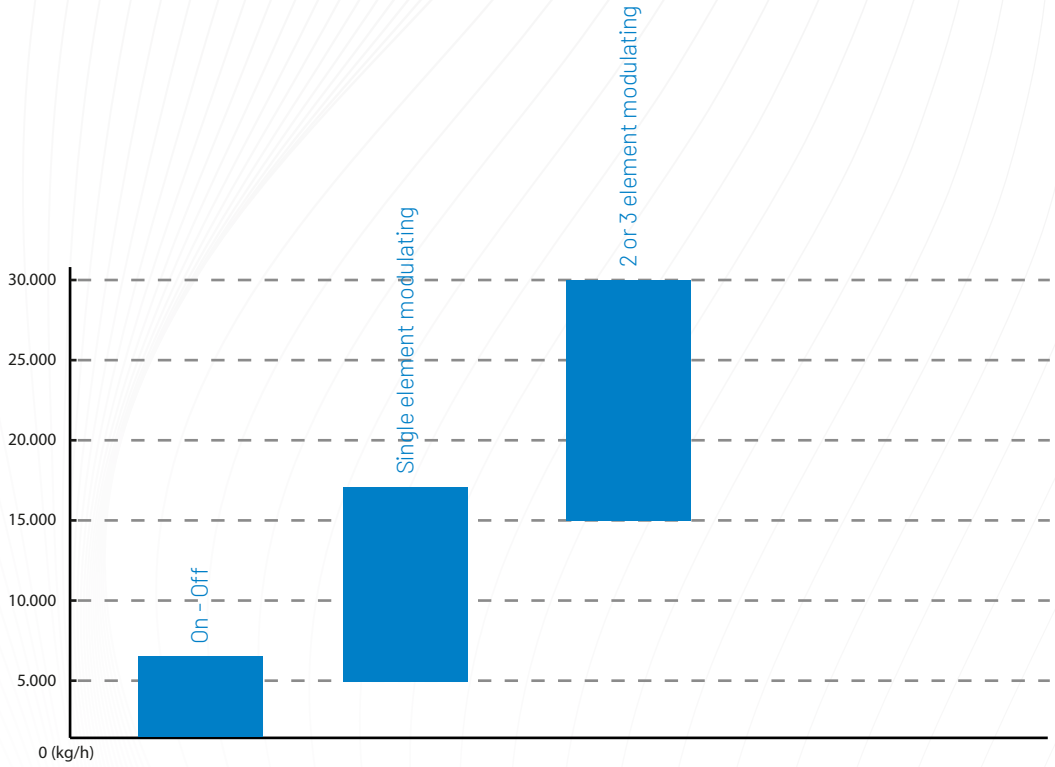
To ensure the safe operation of the boiler, all elements that affect the level control must be monitored and make sure they are working. In case of failure, the boiler operator must understand the cause of the problem and should take action most appropriately.

Boiler Water Level Control Systems

In steam boilers, feed water should be supplied to replace the water lost during steam production. Automatic level control systems are applied in steam boilers produced with modern technology. Automatic feedwater control systems have two different applications: On/Off Level control and modulating level control.

Depending on the boiler capacity; On-Off level control system should be used for the boilers with the capacity up to 5000 kg/h. for the boiler with the capacity up to 15.000 kg/h single element modulating control and higher capacity than 15.000 kg/h 2 or 3 element modulating level control systems should be used.

- **Single Element Modulating** : Modulating level control system only
- **2 Element Modulating** : Modulating level control system, steam production amount measurement with modulating level control system and steam flow meter
- **3 Element Modulating** : Modulating level control system, steam production amount measurement with steam flow meter and feed water amount measurement for the boiler with water flow meter

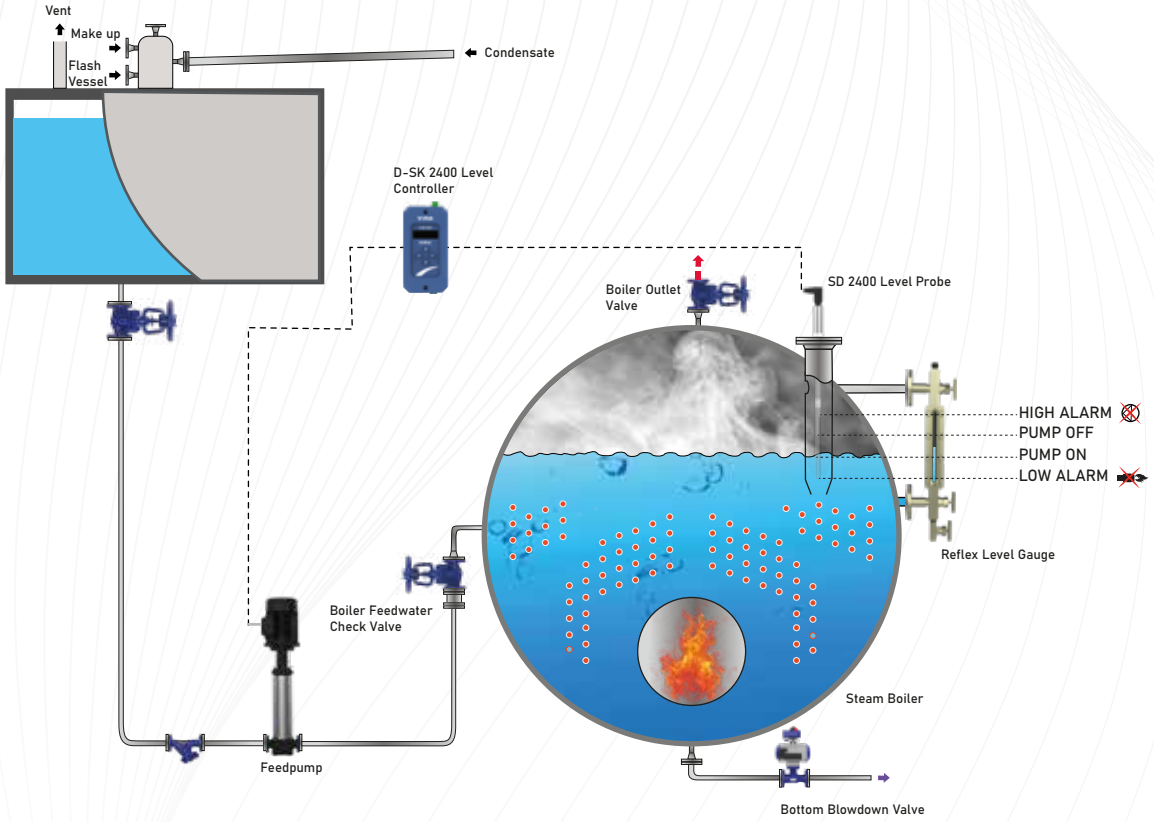


It is not sufficient to decide which level control system to use only by considering the boiler capacity. In practice, factors such as the steam consumption behavior of the plant, the variability of process loads, and the feedwater conditions are equally important. For example, an on-off level control system may not be adequate even in a low-capacity boiler if there are sudden or frequent load fluctuations. In such cases, modulating level control is preferred to ensure stable operation.

Another major reason to use a modulating level control system is energy efficiency. At higher flow rates, adding large amounts of cooler water instead of evaporated water can lead to both energy loss and thermal stress on the boiler. By adding water proportionally to the steam consumption, the boiler can operate more smoothly, reducing thermal shocks and improving fuel efficiency. Therefore, modulating control systems are often selected not only for larger capacity boilers but also for medium or even smaller boilers where load variations are significant or energy efficiency is a priority.

On-Off Level Control & Alarm System

On-Off Automatic Level control system consists of a level probe and a controller. The feed water pump is started when the water level in the boiler reaches the specified lower level and is stopped when the water reaches the specified upper level. The working principle of the system is conductivity. The pump is allowed to start or stop depending on whether the electrodes are in contact with water.



For a safe operation, all steam boilers should have low and high level alarm systems. Additional high and low level alarms can be received from the on-off level control and alarm system.

On-Off Level control and alarm system is used;

- In boilers with a capacity of 5,000 kg/h and less
- Where constant steam load and pressure are not critical
- In backup boilers
- Feed water tanks
- In condensate tanks

SK 2000 On-Off Level Control and Alarm System

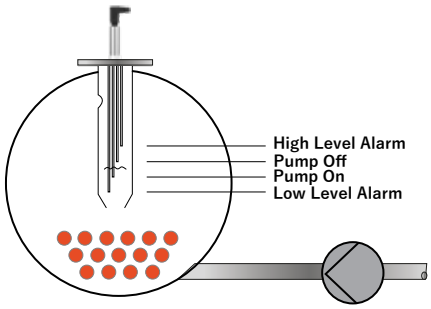
On-Off Level Control and Alarm Controller

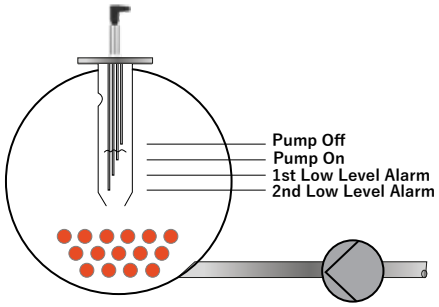
Type	: SK 2400
Supply Voltage	: 230 VAC (+5% / -10%), 50/60Hz
Enclosure	: Panel-mount Type
Functions	: Pump On-Off Control, High & Low Level Alarms
Outputs	: 1 Pump On-Off Relay, 2 Alarm Relays
Max. Ambient Temp	: 55 °C
Compliance	: CE (EMC 2014/30/EU, LVD 2014/35/EU), EN 12952 & EN 12953, Type Approval (Module B + D)

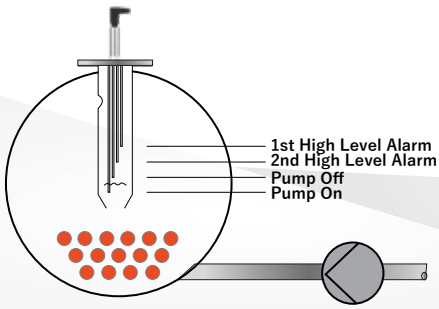
On-Off Level Control and Alarm Probe

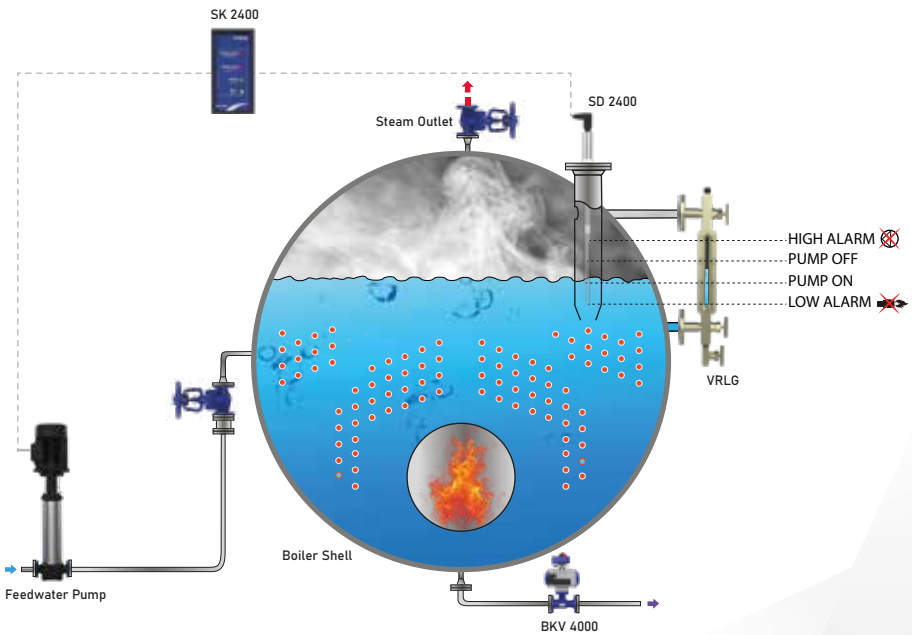
Type	: SD 2400
Nominal Pressure	: PN 40
Max. Operat. Temp.	: 239 °C
Max. Operat. Press.	: 32 Bar g
Connection	: G 1" BSPT (Optional NPT)
Length	: 500, 1000, 1500 mm (can be cut to desired level)
Max. Ambient Temp	: 75 °C
Compliance	: CE (PED 2014/68/EU), EN 12952 & EN 12953, Type Approval (Module B + D)

SK 2000 Typical Installation



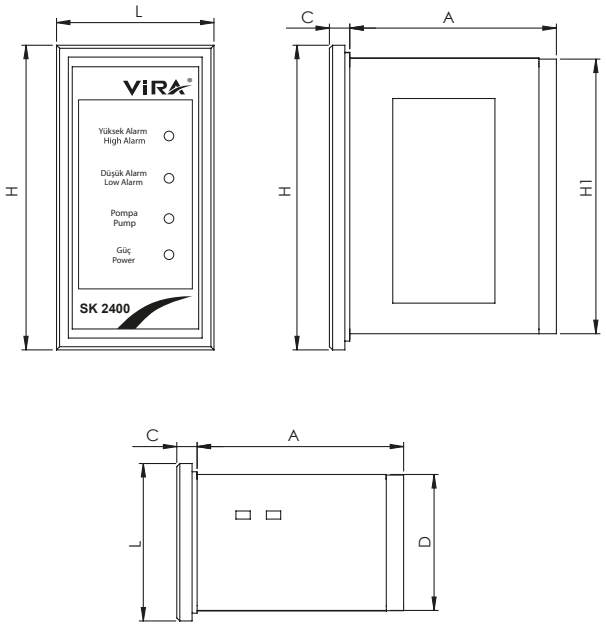






TECHNICAL SPECIFICATION

SK 2400 On-Off Level Control & Alarm Controller



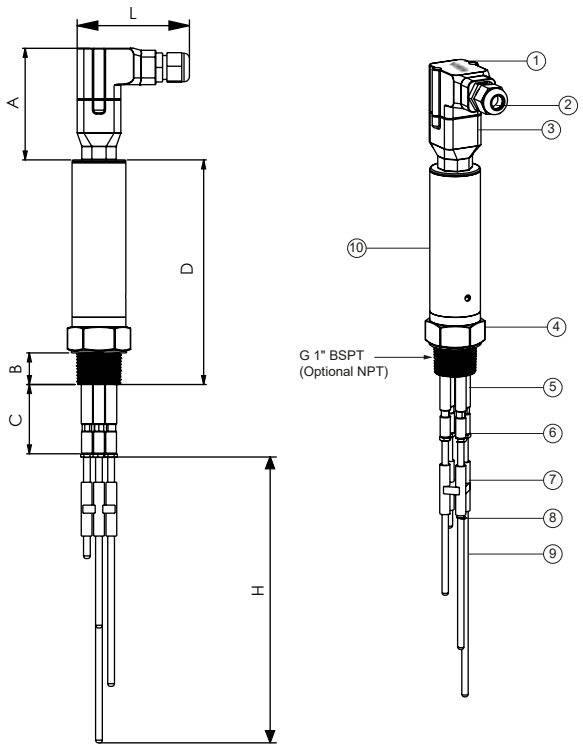
Technical Data

Type	SK 2400
Supply Voltage	230VAC (+5% / -10%), 50/60Hz
Functions	Pump On-Off Control, High & Low Level Alarms
Inputs	Level probe input (4 level), Ground
Outputs	1 Pump Relay, 2 Alarm Relays
Display	Led
Label	Lexan
Max. Ambient Temp.	55℃
Enclosure	PA (Polyamide)
Type	Panel-mount
Protection Class	IP40

Dimensions

H (mm)	H1 (mm)	L (mm)	A (mm)	C (mm)	D (mm)
144	135	72	101	9	67

SD 2400 On-Off Level Control & Alarm Probe



No	Part	Material
1	Upper Connector Housing	GF-PP (Glass Fiber Reinforced Polypropylene)
2	PG 11 Cable Gland	PA6 (Polyamide)
3	Lower Connector Housing	GF-PP (Glass Fiber Reinforced Polypropylene)
4	Probe Body	Austenitic Stainless Steel 304
5	Tip Insulation (Sleeve)	PTFE (Polytetrafluoroethylene)
6	Lock Nuts	Austenitic Stainless Steel 304
7	Tip Steady	Polytetrafluoroethylene (PTFE)
8	Snap Ring	C75 Spring Steel
9	Probe Tips	Austenitic Stainless Steel 316L
10	Label	Laser Marking

Dimensions

H (mm)	L (mm)	A (mm)	B (mm)	C (mm)	D (mm)
500 1000 1500	83,5	83	23,5	51,5	167

Note: The probe tips are supplied in uniform lengths according to the ordered size. The lengths must be cut and adjusted on site to suit the specific application. If 500 mm is ordered, all probe tips will be delivered with a dimension 'H' of 500 mm.