spirax sarco

TI-P401-05
AB Issue 11

IN15, IN25M and IN40M Steam Injectors

Description

Spirax Sarco steam injectors use steam to raise the temperature of water or other liquids. They work by using a jet of steam to draw in the liquid through radial ports, mix it, and distribute the heated liquid throughout the tank or vessel. The circulation induced by the injector ensures thorough mixing and avoids temperature stratification. Three sizes of injector are available to suit a wide range of flowrates.
The smallest, the IN15, has a male and female thread for direct mounting to a tank wall from the outside, or to pipework within the tank.
The IN25M and IN40M are available with either male thread or butt-weld connection and are fitted to pipework in the tank, or to a tank wall connection.
For higher capacities, two or more injectors may be mounted in parallel.

Principal features:

- All stainless steel.
- Ideal for boiler feedtank heating and de-aeration.
- For efficient steam heating of water and other fluids.
- Heats, mixes and circulates - no moving parts.
- Compact design - minimises noise and vibration.

Pressure/temperature limits

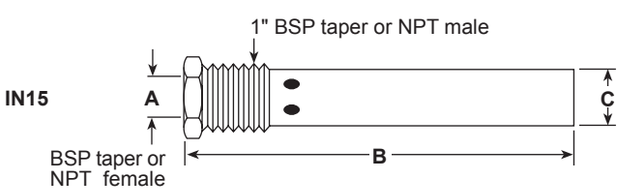
Body design rating	PN25
Minimum operating pressure	0.5 bar g
Maximum saturated steam condition	17 bar g @ 207°C
Maximum heated liquid temperature (tank/vessel vented to atmosphere)	90°C

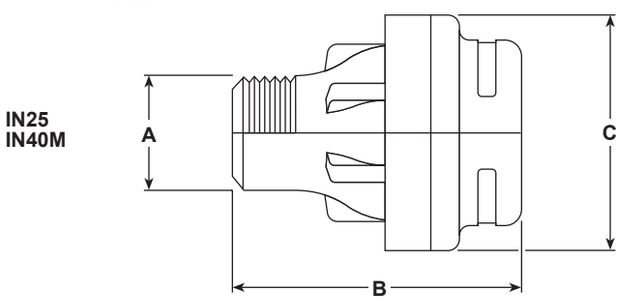
Materials

Austenitic stainless steel ASTM A351 CF3M.

Dimensions/weights (approximate) in mm and kg

Type	A	B	C	Weight
IN15	½"	205	28	0.4
IN25M	1"	84	71	0.8
IN40M	1½"	115	88	1.6





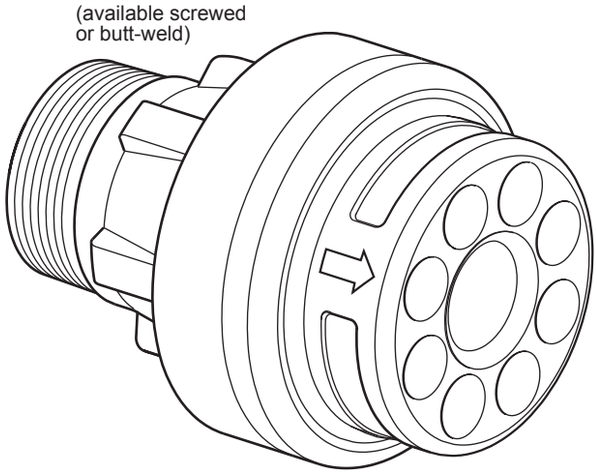
Available types

The IN15 is supplied with a ½" female and 1" male thread, available in BSPT or NPT.

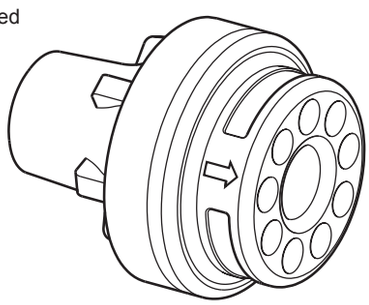
Options for the larger injectors are shown below:

	IN25M	IN40M
BSPT male	1"	1½"
NPT male	1"	1½"
Butt-weld	1" Schedule 80	1½" Schedule 80

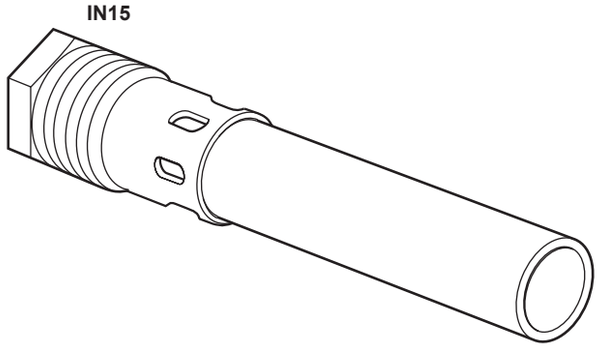
IN40M
(available screwed or butt-weld)



IN25M
(available screwed or butt-weld)



IN15



How to order

Example: 1 off Spirax Sarco IN25M steam injector having a 1" BSPT screwed connection.

Safety information, installation and maintenance

This document does not contain sufficient information to install the product safely. See the Installation and Maintenance Instructions supplied with the product.

Important:
Your attention is drawn to Safety Information Leaflet IM-GCM-10.

Installation note:
The injectors are installed at a low level in a tank, ideally along the centre line, and discharging horizontally along the length. Pipework may be routed inside or outside the tank. In all cases, steam supply pipework must be firmly anchored to prevent vibration and stress in the tank wall. We recommend the use of a suitable thread locking compound on all threaded connections.

Use the same size pipe as the injector, i.e. 25 mm pipe for IN25M. Pipe sizes for multiple injector installations are as follows:-

No. of injectors	Type	Minimum pipe size
2	IN15	20 mm
2	IN40M	65 mm
3	IN40M	80 mm

Allow a minimum of 150 mm between the injector(s) and the sides and bottom of the tank, and as much as possible between the injector outlet and the end of the tank. See the IMI for the minimum limits. Space multiple injectors equally across the tank width.

System examples

The tables below give steam capacities for some typical injector/valve/controller combinations for tanks vented to atmospheric pressure. Intermediate values may be obtained by linear interpolation. For alternatives or special applications refer to specific Spirax Sarco literature or contact our sales engineers.
The tables below are examples only, and the valve/controller combinations shown may not be available in all markets.
Note: Steam pressure at the injector will be much reduced and proper injection and mixing may not occur if a smaller valve (or larger injector) is fitted.

Capacity - selecting a steam injector

The choice of steam injector depends on the flowrate of steam required to heat the liquid. The table below shows steam injector capacities in kg/h of injected steam when heating tanks are vented to atmosphere, and are up to 3 metres deep. The choice of control valve can affect the steam capacity.

For higher capacities use two or more injectors in parallel.

Injector type	IN15	IN25M	IN40M
System pressure bar g	**Saturated steam capacity kg/h**		
0.5	11	75	222
1	20	135	400
2	48	175	580
3	66	280	805
4	84	350	970
5	102	410	1125
6	120	500	1295
7	138	580	1445
8	156	640	1620
9	174	700	1820
10	192	765	1950
11	210	830	2250
12	228	900	2370
13	246	975	2595
14	264	1045	2710
15	282	1095	2815
16	300	1170	3065
17	318	1225	3200

Self-acting control system examples

Injector type	IN15		IN25M	IN40M		
Number off	1	2	1	1	2	3
Valve type/size	BX6 DN15	SB DN15	SB DN20	KB51 DN25	KC51 DN40	KC51 DN50
Valve Kv	1.65	2.58	3.81	9.8	16.48	34.0
Controller type	Self-acting control with 2 m capillary Range 1. -20°C to 110°C			Self-acting control with 2 m capillary Range 2. 40°C to 105°C		
Steam supply pressure bar g	**System saturated steam capacity kg/h**					
2	47	82	110	350	580	1150
4	78	140	200	550	1000	1750
6	109	195	280	750	1400	2525
8	142	236	360	1 000	1750	3200
10	171	310	450	1 200	2075	3800
12	201	365	-	-	2500	4500
13	218	393	-	-	2675	5000

Electric or pneumatic control system examples

Injector type	IN15		IN25	IN40M		
Number off	1	2	1	1	2	3
Valve type/ size	KE71/KE73 DN15	KE71/KE73 DN15	KE71/KE73 DN15	KE71/KE73 DN25	KE71/KE73 DN32	KE71/KE73 DN50
Valve Kv	1.6	4	4	10	16	36
Steam supply pressure bar g	**System saturated steam capacity kg/h**					
2	47	96	110	350	580	1150
4	78	168	200	550	1100	1750
6	109	240	280	750	1400	2525
8	142	312	360	1000	1750	*
10	171	384	450	1200	2075	*
12	201	456	650	1650	*	*
13	218	492	750	1750	*	*

The information given in the tables is empirical and must not be used for critical applications. Use PN5123 or EL5601 actuator, EP5 positioner (PN), SX65 controller (available with mA output for PN actuator, or VMD output for EL actuator), EL2270 sensor or pocket, and MP2 regulator.
*** Consult your local Spirax Sarco sales engineer for information.**

TI-P401-04
EMM Issue 4

INS6 and INS10
Direct Steam Injection Heating Systems

**A complete system for boiler feedtank,
hot water storage and other industrial process heating requirements.**

Principal features:

- Stainless steel injector for long life
- Simple installation
- Self-acting system requiring no external power supply
- Efficient and economic heating
- Single seated valve giving tight shut-off

General description

Spirax Sarco INS direct steam injection heating systems are designed to inject steam into tanks of water or process liquor to ensure quiet and efficient heating of the tank contents. The injector draws in cold liquid, mixes it with steam within the injector nozzle and distributes the hot liquid throughout the tank. In many applications the circulation induced by the injector is an advantage ensuring thorough mixing and avoiding temperature stratification.

Available system types

INS6 and INS10, screwed BSP (BS 21 parallel) or NPT. The injectors are for horizontal installation. The selection of a system depends on the flowrate of steam required to heat the tank contents and the steam supply pressure to the correct valve.

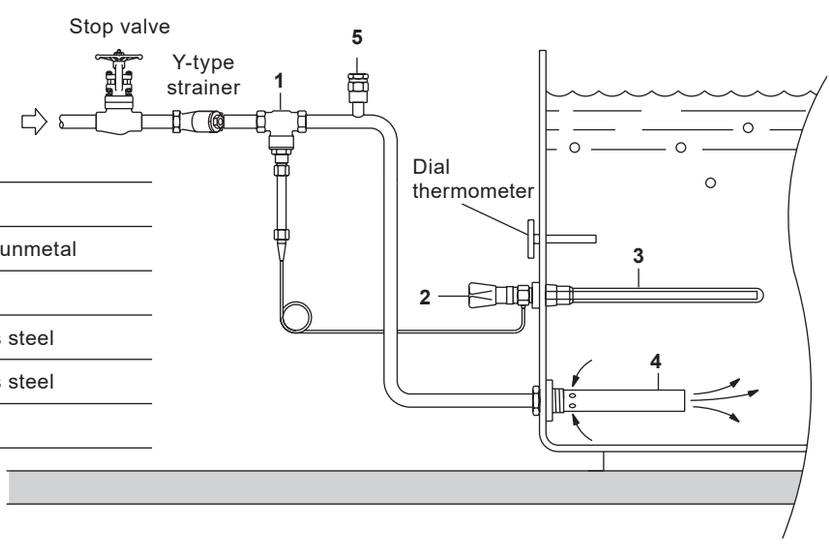
Boiler feedtank applications

Oxygen must be removed from boiler water if corrosion is to be prevented. Oxygen can be removed in two ways, either by the use of oxygen scavenging chemicals or by thermal deaeration.

The dissolved oxygen content of water:

- At 20 °C is 9 ppm
- At 60 °C is 5 ppm
- At 90 °C is just under 2 ppm.

By heating the boiler feedwater typically to 85 - 90 °C to remove most of the oxygen, and using oxygen scavenging chemicals, the use of chemicals can be reduced by up to 75%. Additionally, boiler efficiency may be increased since blowdown requirements may be lowered. The fitting of a dial thermometer on the tank is recommended and is available from Spirax Sarco.



System components

No.	Part	Material
1	Control valve	Bronze/gunmetal
2	Controller and sensor	Brass
3	Sensor pocket	Stainless steel
4	Injector	Stainless steel
5	Vacuum breaker	Brass

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Capacities

System capacities in kg/h of injected steam when heating tanks vented to atmospheric pressure.

System type		INS6	INS10
Control valve size		½" BSP with 6 mm orifice	½" BSP
Steam supply pressure		Capacities in kg/h of saturated steam	
bar g	psi g		
2	29	47	82
3	44	63	110
4	58	78	140
5	73	94	168
6	87	109	195
7	102	125	223
8	116	142	236
9	131	155	282
10	145	171	310
11	160	186	338
12	174	201	365
13	189	218	393

Where steam supply pressures are higher consider the use of a pressure reducing valve or alternatively, the use of a combined pressure reducing and temperature control valve. Please consult Spirax Sarco for a suitable type.

Equipment details

Note: All equipment is available screwed BSP or NPT.

System type	Control valve*		Controller type	Range	Sensor pocket	Steam injector	Vacuum breaker
INS6	BX6	½"	SA128 with 2 m capillary	Range 1 -20 to 110 °C	Stainless steel - 1" to suit SA128	1 x IN15 ½" female x 1" male	VB14 - ½"
INS10	SB					2 x IN15 ½" female x 1" male	

* BX6 and SB control valves are bronze, single seat, normally open, direct acting.

A Y-type stainer is recommended upstream of the control valve. The Y-type strainer should normally be the same size as the steam supply pipeline. Consider a Spirax Sarco brass/bronze Fig 12 strainer.

An isolating valve is recommended upstream of the Y-type strainer.
Consider the use of an M10 Spirax Sarco carbon steel ball valve or a HV3 bronze stop valve.

Safety information, installation and maintenance

This document does not contain sufficient information to install the system safely. See the relevant Installation and Maintenance Instructions supplied with system components.

Safety note: Your attention is drawn to Safety Information Leaflet IM-GCM-10.

Installation note: Spirax Sarco direct steam injection heating systems are designed to operate with the minimum of noise provided the installation is correct.

How to order

Example: 1 off Spirax Sarco INS6, ½" screwed BSP, direct steam injection heating system.

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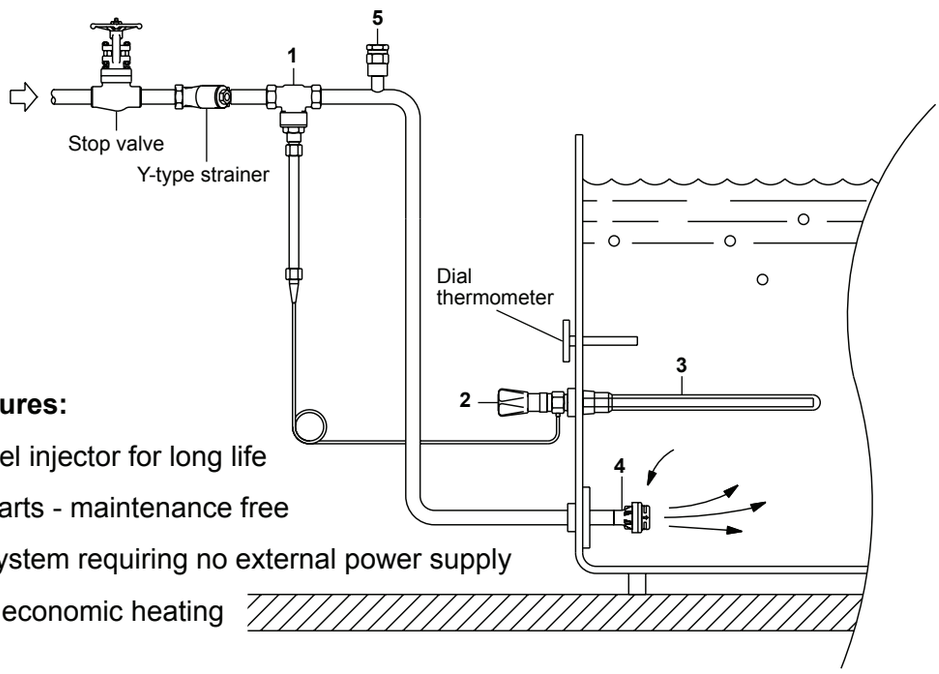
TI-P401-03
AB Issue 5

INS
Direct Steam Injection Heating Systems

A complete system for boiler feedtank, hot water storage and other industrial process heating requirements.



Principal features:

- Stainless steel injector for long life
- No moving parts - maintenance free
- Self-acting system requiring no external power supply
- Efficient and economic heating

General description

Spirax Sarco INS direct steam injection heating systems are designed to inject steam into tanks of water or process liquor to ensure quiet and efficient heating of the tank contents. The injector draws in cold liquid, mixes it with the steam within the injector nozzle and distributes the hot liquid throughout the tank. In many applications the circulation induced by the injector is an advantage ensuring thorough mixing and avoiding temperature stratification.

Available system types

INS15, INS20, INS25, INS40, INS50, INS65 and INS80, screwed BSP (BS 21 parallel) or NPT.
The injectors are for horizontal installation.
The selection of a system depends on the flowrate of steam required to heat the tank contents and the steam supply pressure to the control valve.

Boiler feedtank applications

Oxygen must be removed from boiler water if corrosion is to be prevented. Oxygen can be removed in two ways, either by the use of oxygen scavenging chemicals or by thermal de-aeration.

The dissolved oxygen content of water:
- At 20°C is 9 ppm
- At 60°C is 5 ppm
- At 90°C is just under 2 ppm.

By heating the boiler feedwater typically to 85 - 90°C to remove most of the oxygen, and using oxygen scavenging chemicals in the feedline after the tank, the use of chemicals can be reduced by up to 75%. Additionally, boiler efficiency may be increased since blowdown requirements may be lowered. The fitting of a dial thermometer on the tank is recommended and is available from Spirax Sarco.

System components

No.	Part	Material
1	Control valve	Bronze/gunmetal
2	Controller and sensor	Brass
3	Sensor pocket	Stainless steel
4	Horizontal injector	Stainless steel
5	Vacuum breaker	Brass

Capacities

System capacities in kg/h of injected steam when heating tanks vented to atmospheric pressure.

System type		INS15	INS20	INS25	INS40	INS50	INS65	INS80
Control valve Size		½" BSP	¾" BSP	1" BSP	1½" BSP	2" BSP	2½" BSP	3" BSP
Steam supply pressure bar g	psi g	Capacities in kg/h of saturated steam						
2	29	87	110	350	580	1 150	2 500	3 700
3	44	120	160	425	750	1 400	3 350	4 900
4	58	150	200	550	1 000	1 750	4 200	6 000
5	73	180	240	650	1 150	2 100	5 000	7 200
6	87	215	280	750	1 400	2 525	5 800	8 400
6.9	100	237	316	840	1 535	2 800	6 500	9 450
7	102	240	320	850	1 550	2 950	6 600	9 550
8	116	275	360	1 000	1 750	3 200	7 400	10 700
8.2	118	278	370	1 020	1 780	3 280	7 550	10 950
9	131	290	410	1 100	1 900	3 600	8 200	11 850
10	145	315	450	1 200	2 075	3 800	9 000	13 000
10.3	150	325	460	1 230	2 135	3 920	-	-
11	160	350	-	-	2 275	4 200	-	-
12	174	375	-	-	2 500	4 500	-	-
13	189	400	-	-	2 675	5 000	-	-

Where steam supply pressures are higher consider the use of a pressure reducing valve or alternatively, the use of a combined pressure reducing and temperature control valve. Please consult Spirax Sarco for a suitable type.

Equipment details

Note: All equipment is available screwed BSP. For options of NPT or API connections refer to relevant literature.

System type	Control valve*		Controller type	Range	Sensor pocket	Steam injector	Vacuum breaker
INS15	SB	½"	SA128 with 2 m capillary	Range 1 -20 to 110°C	Stainless steel - 1" to suit SA128	1 x IN25M - 1"	VB14 - ½"
INS20	SB	¾"	SA128 with 2 m capillary	Range 1 -20 to 110°C	Stainless steel - 1" to suit SA128	1 x IN25M - 1"	VB14 - ½"
INS25	KB51	1"	SA128 with 2 m capillary	Range 1 -20 to 110°C	Stainless steel - 1" to suit SA128	1 x IN40M - 1½"	VB14 - ½"
INS40	KC51	1½"	SA121 with 2 m capillary	Range 2 40 to 105°C	Stainless steel - 1" to suit SA121	2 x IN40M - 1½"	VB14 - ½"
INS50	KC51	2"	SA121 with 2 m capillary	Range 2 40 to 105°C	Stainless steel - 1" to suit SA121	3 x IN40M - 1½"	VB14 - ½"
INS65	NS	2½"	SA121 with 2 m capillary	Range 2 40 to 105°C	Stainless steel - 1" to suit SA121	5 x IN40M - 1½"	VB14 - ½"
INS80	NS	3"	SA121 with 2 m capillary	Range 2 40 to 105°C	Stainless steel - 1" to suit SA121	7 x IN40M - 1½"	VB14 - ½"

* SB control valve is bronze, single seat, normally open, direct acting.
KB51 and KC51 control valves are bronze, single seat, normally open, bellows balanced, direct acting.
NS control valve is gunmetal, double seat, normally open, stainless steel trim, direct acting.

A Y-type strainer is recommended upstream of the control valve. The Y-type strainer should normally be the same size as the steam supply pipeline. Consider a Spirax Sarco brass / bronze Fig 12 strainer.

An isolating valve is recommended upstream of the Y-type strainer.
Consider the use of an M10 Spirax Sarco carbon steel ball valve or a HV3 bronze stop valve.

Safety information, installation and maintenance

This document does not contain sufficient information to install the system safely. See the relevant Installation and Maintenance Instructions supplied with the system components.

Safety note:
Your attention is drawn to Safety Information Leaflet IM-GCM-10.

Installation note:
Spirax Sarco direct steam injection heating systems are designed to operate with the minimum of noise provided the installation is correct.

How to order

Example: 1 off Spirax Sarco INS15, ½" screwed BSP, direct steam injection heating system.

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TI-P401-06
AB Issue 5

SD
Steam Distributor

Description
Spirax Sarco steam distributors distribute low pressure flash steam into atmospheric water tanks. They ensure rapid condensation of the steam and efficient heating of the water. The hole configuration provides a self-regulating control feature ensuring that holes progressively come into use as the steam flowrate increases. An internal stainless steel mesh ensures quiet operation.

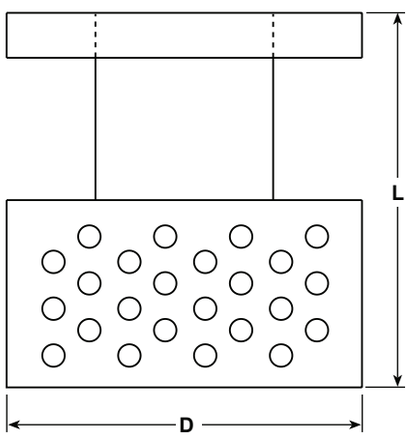
Principal features:
- Simple installation - no special supports required.
- Compact, lightweight and strong.
- Stainless steel for long life.
- Eliminates waterhammer.
- Quiet operation.

Application - Boiler blowdown heat recovery
Steam distributors are ideal for supplementing the heating of boiler feedwater tanks using flash steam. When used in conjunction with a flash vessel, as part of a boiler blowdown heat recovery system, flash steam recovery is simple, of low capital cost and is maintenance free. Additionally, the flash steam is condensed to pure water reducing the amount of make-up water and chemical treatment required. Generally for sizing purposes use a differential pressure of 0.4 bar. Steam distributors are not recommended for condensate recovery or live steam injection duties, as they may be damaged by waterhammer.

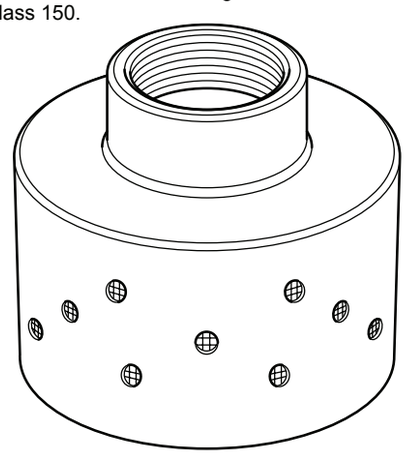
Materials
Austenitic stainless steel 304.

Dimensions (approximate) in millimetres

Steam distributor	Connection	D	L
SD40S	Screwed 1½" BSP or NPT Female	100	70
SD50S	Screwed 2" BSP or NPT Female	150	85
SD80S	Screwed 3" BSP or NPT Female	215	110
SD80	Flanged DN80 PN16 or Class 150	215	180
SD100	Flanged DN100 PN16 or Class 150	235	210
SD150	Flanged DN150 PN16 or Class 150	305	220



Available types
SD40S, **SD50S** and **SD80S** screwed BSP (BS 21 parallel) or NPT. **SD80**, **SD100** and **SD150** flanged to suit EN 1092 PN16 or ASME Class 150.



Screwed SD type steam distributor shown. **Note:** flanged connections are available.

Limiting conditions
Not suitable for live steam applications.
Maximum saturated steam conditions 1 bar g @ 130°C
Recommended maximum flash vessel operating pressure is 0.4 bar.

Capacities
Each distributor has a number of holes. The flow of steam through the holes depends on the differential pressure available. The table below shows capacities in kg/h of distributed steam when heating tanks which are vented to atmospheric pressure.

Steam supply pressure bar g	Steam distributor SD40S	SD50S	SD80S & 80	SD100	SD150
0.2	99	176	396	643	935
0.4	135	240	540	877	1275
0.6	171	304	684	1111	1615
0.8	198	352	792	1287	1870

Intermediate values may be obtained by linear interpolation.
For higher capacities use 2 or more distributors in parallel.

Safety and installation information
Steam distributors operate at temperatures which could cause severe scalding, and produce strong currents of very hot steam/water. Do not touch or lean over open tanks which are being heated, even if the water still appears to be cold. Ensure closed tanks are adequately vented and that the vent is unobstructed. Steam supply pipework must be firmly anchored to prevent vibration and stress in the tank wall. Tanks must be adequately constructed and braced/stayed as necessary to avoid vibration. Consult your local Spirax Sarco engineer if in any doubt.

Installation note:
Fit the end of a vertical downpipe in the tank so that the bottom of the distributor is at about ⅓ off the working depth of tank. The piping between the steam source and distributor should be the same nominal size as the connection on the distributor. It is recommended that the piping is less than 10 m in length in order to minimise the pressure drop.

Disposal:
This product is recyclable. No ecological hazard is anticipated with the disposal of this product, providing due care is taken.

How to order
Example: 1 off Spirax Sarco 1½" SD40S steam distributor having a screwed BSP connection.

2 Boiler house
Steam injectors