

# Direct steam injection humidifiers



*First for Steam Solutions*

EXPERTISE | SOLUTIONS | SUSTAINABILITY

**spirax**  
**sarco**

## Direct steam injection gives quality control of air humidity

Research and development in separation, the use of lightweight stainless steel combined with a constant temperature lance system, has created new standards in direct steam humidification. These features provide quality, efficiency and all round value for money.

### Effective moisture separation

The major factors that lift the total performance of Spirax Sarco S.I. humidifiers above other manufacturers are:

- A highly effective combination of centrifugal, vortex and baffle separation which ensures the driest steam is available at all times.
- The twin chamber separator which supplies the lance and pre-heat circuit.
- The capability to handle high steam loads without the loss of separator efficiency.
- Low mass, with high strength, allows fast warm-up.
- The consistent condensate discharge without re-entrainment.

### Effective steam injection

Once the separator has completed its job, it is necessary to then deliver the steam into the air as a gas, (not as a water laden atmosphere). This is achieved through the Spirax Sarco lance by:

- Continuous heating over the full length of the lance.
- Ejection nozzles which take steam from the hottest part of the lance.
- Low mass for rapid pre-heating.
- The constant re-evaporation of any condensate in the lance.
- The extremely small lance surface area reduces the cooling effect and air flow resistance.

### Why choose S.I. humidifiers?

The benefits of choosing S.I. humidifiers over other manufacturers has to be the simple fact, it is an effective system which ensures:

- High steam output per metre of lance.
- Very low noise levels.
- Simplified duct and piping requirements.
- Close spacing where multiple lances are needed.
- Low steam ejection velocity for efficient air / steam mixing.

**S.I. steam injection humidifiers can be adapted to a wide range of duct sizes, temperatures and air velocities, with few additional components required. Alternative makes of valve and actuator can be supplied.**

## User benefits

- The cleanliness of Legionella free steam
- Rapid moisture absorption with minimal temperature rise
- Small, compact and lightweight for easy low cost installation
- Wide product choice
- Simple construction in quality stainless steel
- Few working parts giving minimal maintenance
- Ultra low noise levels
- Spirax Sarco's guarantee of worldwide technical support, knowledge and service.



## Typical applications

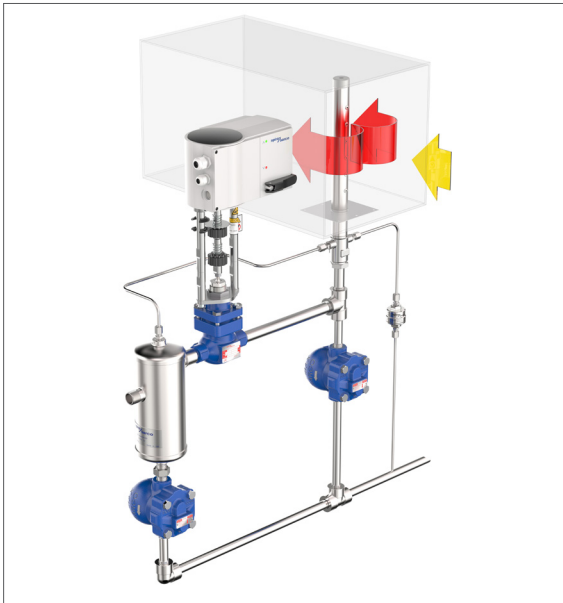
The most common application for humidification by direct steam injection occurs in air supply ducts used for control within living and office environments. The versatile Spirax Sarco S.I. humidifier can easily accommodate the wide variety of applications and installations encountered, some of which are shown below.



Horizontal lance in horizontal duct\*



Horizontal lance in vertical duct\*



Vertical lance in horizontal duct



Multiple horizontal lances in horizontal duct\*

*Note: These illustrations are general with some components omitted for clarity.*

\*Insertion of lance can be from either left or right side of ducting.

# Product selection

The best diffusion of steam into the air flow is achieved by spreading the outlet nozzles of the lance(s) evenly within the duct, vertically and horizontally. This is achieved by following the example through the five steps below.

## 1. The known data

|   |                                    |
|---|------------------------------------|
| <b>Duct size:</b>                       | 1,800 mm high<br>and 1,800 mm wide |
| <b>Steam pressure:</b>                  | 1.5 bar g                          |
| <b>Required maximum steam flowrate:</b> | 110 kg/h                           |
| <b>Spirax Sarco valve:</b>              | Screwed                            |
| <b>Valve actuation:</b>                 | Electric                           |
| <b>Actuator voltage:</b>                | 24 Vac 50/60 Hz                    |
| <b>Control signal:</b>                  | VMD                                |

## 2. Select the lance

Select the recommended number of lances required from Table 1 to match the known duct height.

Table 1

| Duct height in mm | Number of lances |
|-------------------|------------------|
| up to 1 000       | 1                |
| 1 000 - 1 700     | 2                |
| 1 700 - 2 200     | <b>3</b>         |
| 2 200 - 2 600     | 4                |
| 2 600 and above   | 5                |

**Number of recommended lances required = 3**

## 3. Select the lance model

Select the lance model from Table 2 to match the known duct width.

Table 2

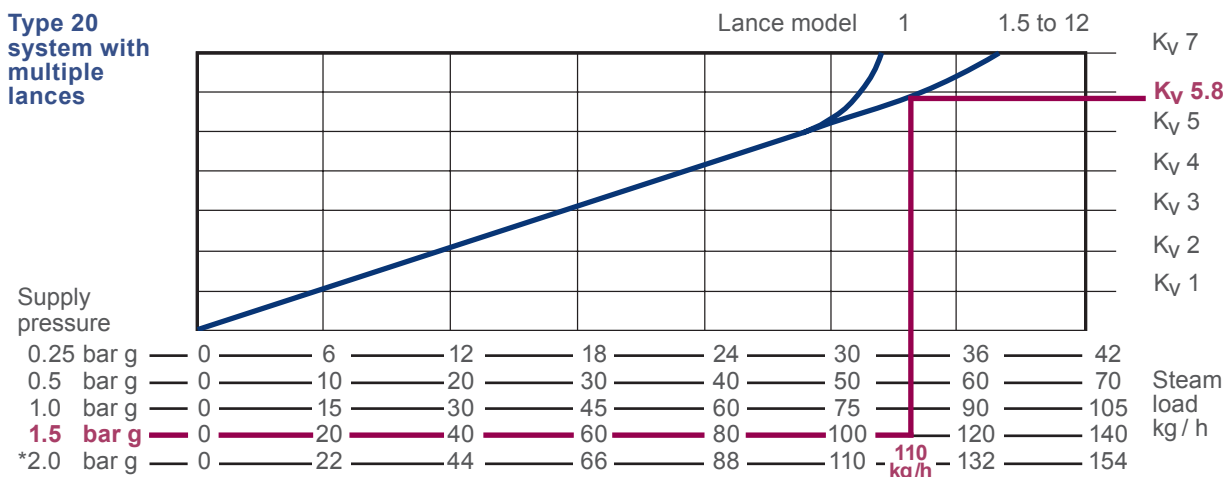
| Duct width in mm | Number of lances |     |     |       |       |       |       |       |       |       |       |       |       |
|------------------|------------------|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                  | 1                | 1.5 | 2   | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    |
| Maximum          | 450              | 630 | 900 | 1 200 | 1 470 | 1 780 | 2 080 | 2 380 | 2 690 | 3 000 | 3 300 | 3 610 | 3 950 |
| Minimum          | 280              | 450 | 630 | 900   | 1 200 | 1 470 | 1 780 | 2 080 | 2 380 | 2 690 | 3 000 | 3 300 | 3 610 |
| Lance model      | 1                | 1.5 | 2   | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    |

**Recommended lance model = 6**

## 4. Select the system

Select the system that will handle the known capacity (Type 20 or Type 40) to obtain the required valve Kv. See page 6 and the example below.

**Type 20 system with multiple lances**



\*Recommended maximum inlet steam pressure to separator for quiet operation of the humidifier. For operating pressures above 2 bar g consult Spirax Sarco.

### 5. Select the control valve and separator

Having selected the required valve Kv, the actual valve size and actuator can now be found from the chart headed Valve selection on page 7. Always select the next highest valve Kvs, to the Kv required.

**Recommended control valve is a DN20 LE31 with screwed BSP connections.**

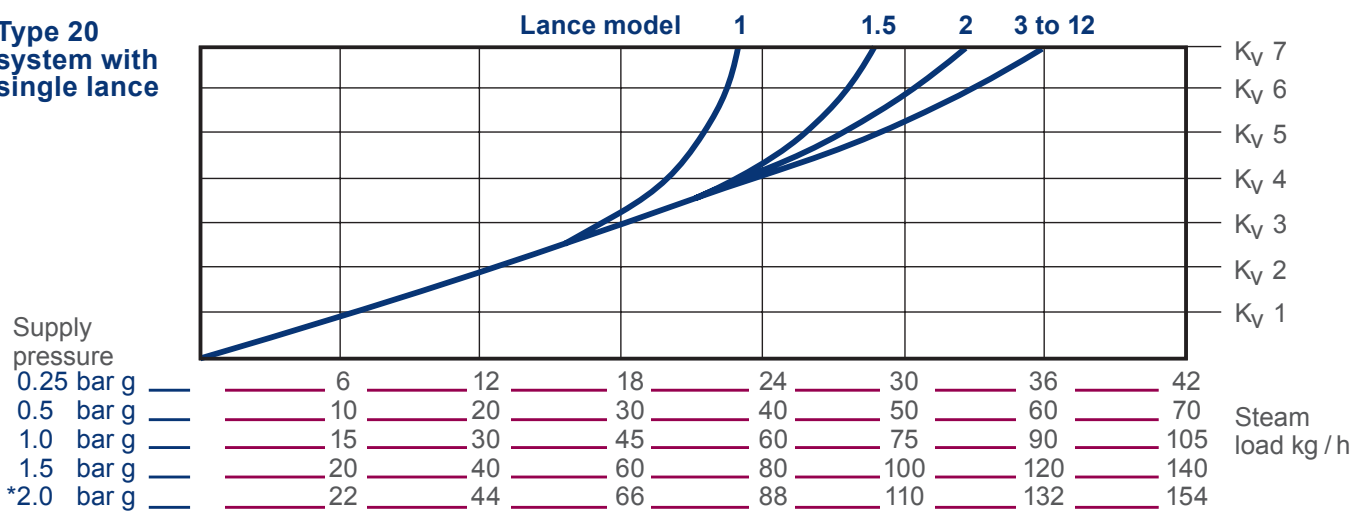
**Recommended actuator is a AEL3E for 24 V operation VMD control signal.**

### Final product selection and specification

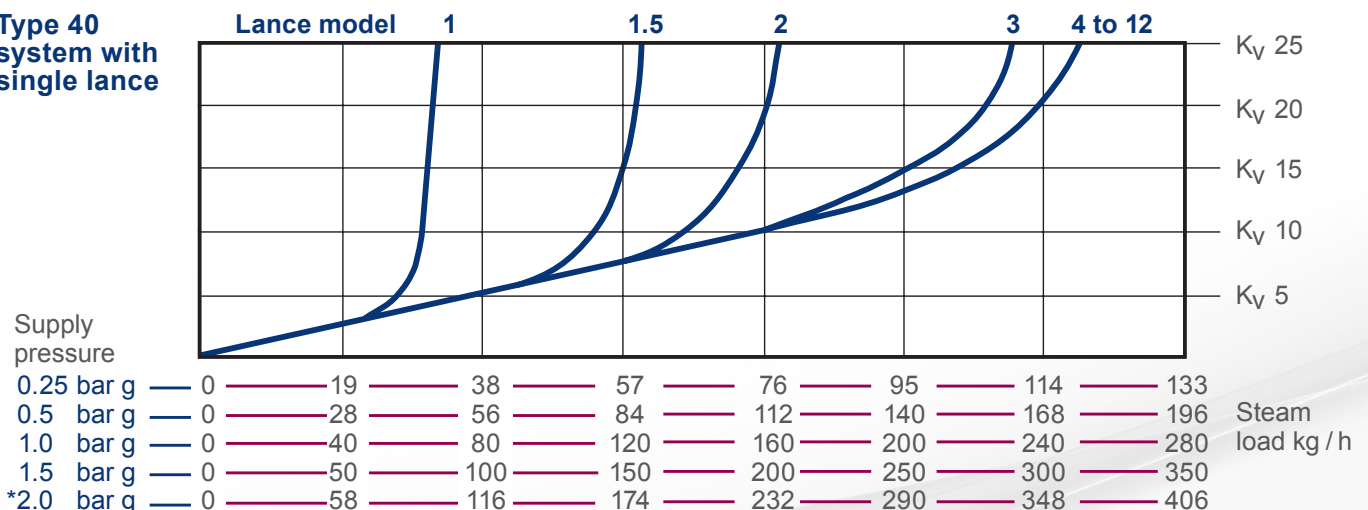
From the above example: 1 x Spirax Sarco S.I. humidifier for 110 kg / h at 1.5 bar g; 1 x Type 20 separator with DN20 LE31 valve screwed BSP, with AEL3E actuator for 24 V operation VMD control signal, and 3 x Type 20 model 6 lances.

## System sizing

**Type 20 system with single lance**



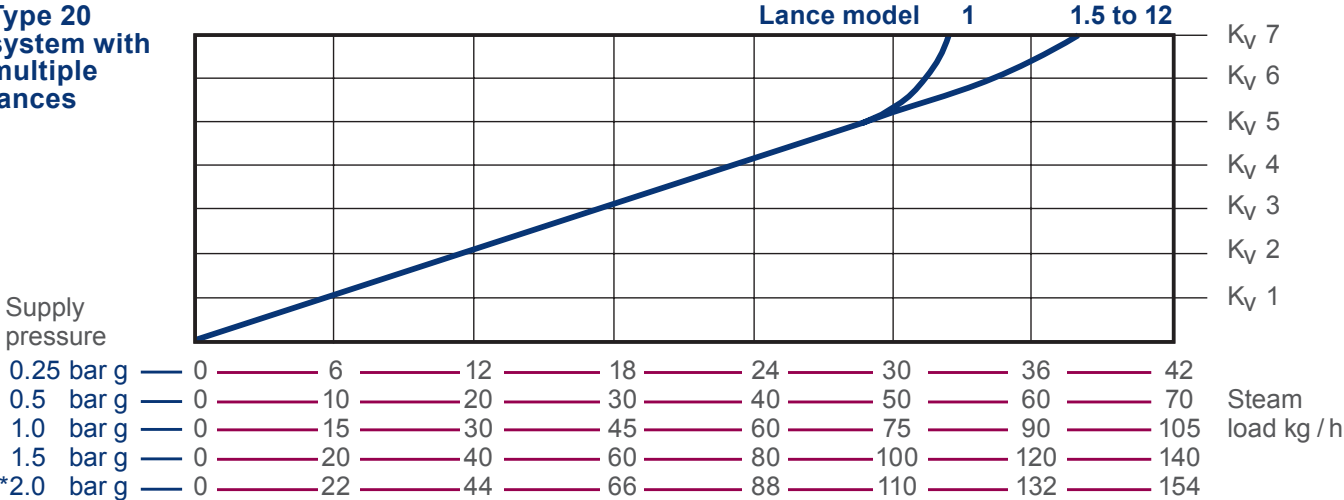
**Type 40 system with single lance**



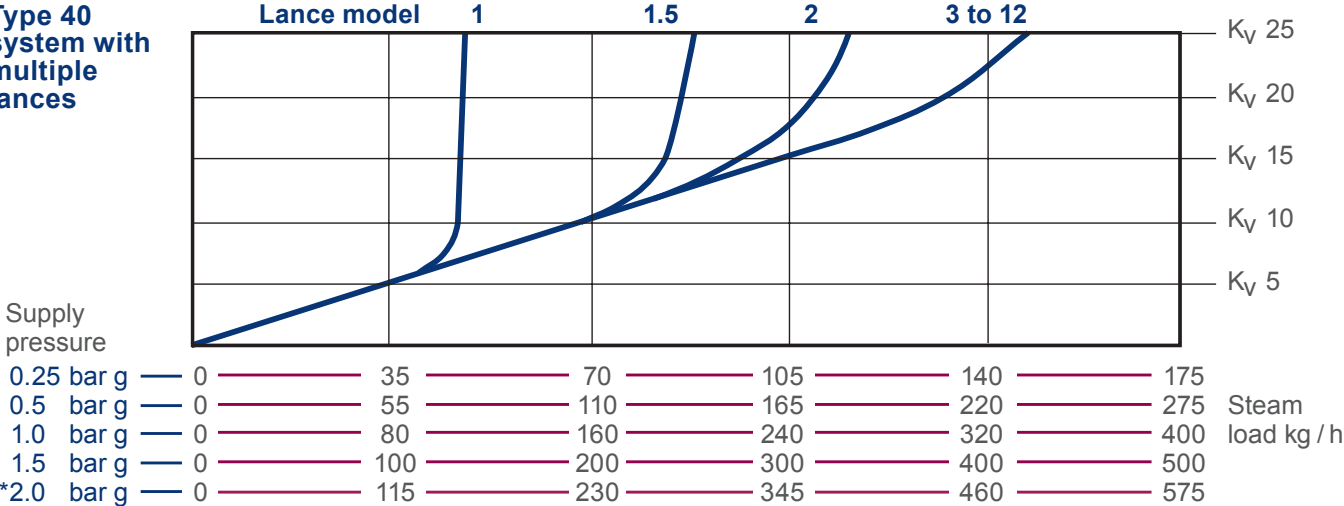
\*Recommended maximum inlet steam pressure to separator for quiet operation of the humidifier.

<sup>6</sup> For operating pressures above 2 bar g consult Spirax Sarco.

**Type 20 system with multiple lances**



**Type 40 system with multiple lances**

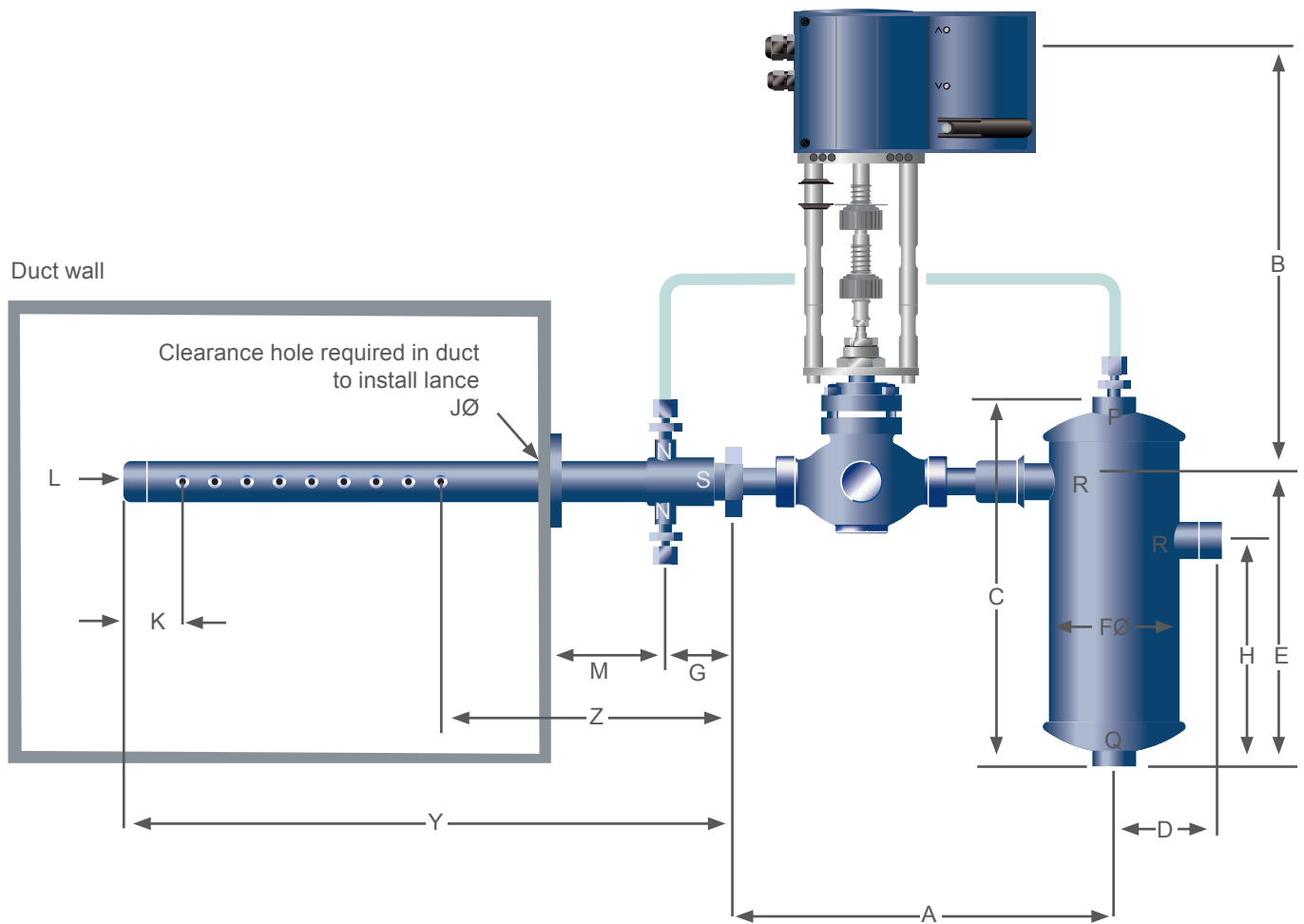


\*Recommended maximum inlet steam pressure to separator for quiet operation of the humidifier. For operating pressures above 2 bar g consult Spirax Sarco.

## Valve selection

| K <sub>vs</sub><br>Min | Size<br>280 | Valve selection<br>cast iron |         | Actuator selection                         |   |   |  |
|------------------------|-------------|------------------------------|---------|--|---|---|--|
|                        |             | Screwed                      | Flanged | Pneumatic<br>0.2 – 1.0 bar<br>spring range | Electric, 230<br>Vac, VDM, 0-10<br>Vdc, 4-20 mA | Electric, 100/110<br>Vac, VDM, 0-10<br>Vdc, 4-20 mA | Electric, 24 Vac/<br>dc, VDM, 0-10<br>Vdc, 4-20 mA |
| 0.4                    | DN15        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 1.0                    | DN15        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 1.6                    | DN15        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 4.0                    | DN15        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 6.3                    | DN20        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 10.0                   | DN25        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 16.0                   | DN32        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |
| 25.0                   | DN40        | LE31                         | LE33    | PN9220E                                    | AEL3E   | AEL3E   | AEL3E  |

Note: Please contact Spirax Sarco for other actuators and valves that are available from their range. Should a positioner be required for the selected pneumatic actuator then please refer to the relevant Technical Information (TI) sheet.





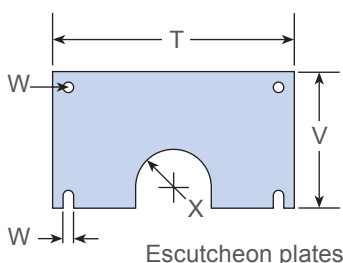
# Dimensions (Approximate in millimetres)

| Assembly |         |         | Type20             | Type40 |
|----------|---------|---------|--------------------|--------|
| DN15     | A       | Screwed | 213                |        |
|          |         | Flanged | 300                |        |
| DN20     | A       | Screwed | 192                | 340    |
|          |         | Flanged | 290                | 440    |
| DN25     | A       | Screwed |                    | 330    |
|          |         | Flanged |                    | 405    |
| DN32     | A       | Screwed |                    | 340    |
|          |         | Flanged |                    | 430    |
| DN40     | A       | Screwed |                    | 270    |
|          |         | Flanged |                    | 375    |
|          | C       |         | 270                | 395    |
|          | D       |         | 85                 | 120    |
|          | E       |         | 208                | 316    |
|          | F Ø 105 |         | 105                | 152    |
|          | G       |         | 40                 | 48     |
|          | H       |         | 165                | 246    |
|          | J Ø 38  |         | 38                 | 54     |
|          | K       |         | 60                 | 60     |
|          | L       |         | M10                | M10    |
|          | M       |         | 50 min. to 80 max. |        |

| Actuator type |   | Pneumatic | Electric |
|---------------|---|-----------|----------|
| DN15          | B | 403       | 446      |
| DN20          | B | 403       | 446      |
| DN25          | B | 403       | 446      |
| DN32          | B | 433       | 475      |
| DN40          | B | 433       | 475      |

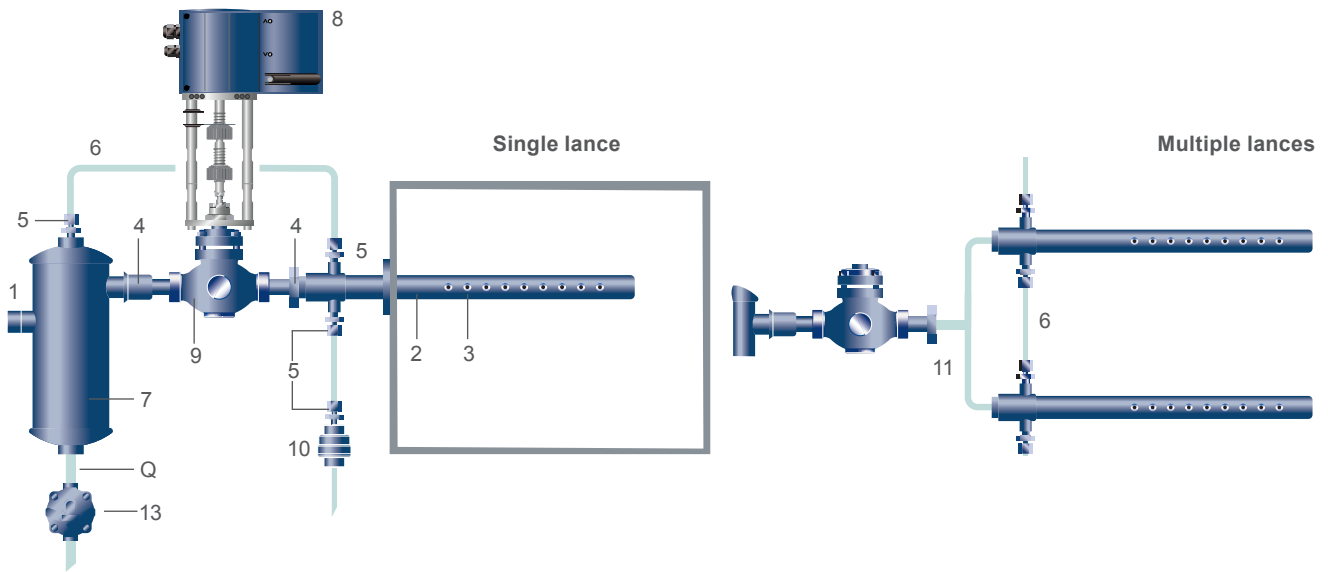
| Pipe connections BSP (ISO) | Type20 | Type40 |
|----------------------------|--------|--------|
| N                          | 1/4"   | 1/4"   |
| P                          | 1/4"   | 1/4"   |
| Q                          | 1/2"   | 1"     |
| R                          | 3/4"   | 1 1/2" |
| S                          | 1"     | 1 1/2" |

| Escutcheon plates |      |      |
|-------------------|------|------|
| T                 | 115  | 115  |
| V                 | 65   | 65   |
| W                 | 5    | 5    |
| X                 | 17.5 | 25.5 |



| Lance model |        | Type20  | Type40  |
|-------------|--------|---------|---------|
| 1           | Y      | 338     | 345     |
|             | Z      | 138     | 137     |
|             | Weight | 0.88 kg | 1.54 kg |
| 1.5         | Y      | 513     | 520     |
|             | Z      | 173     | 152     |
|             | Weight | 1.14 kg | 1.97 kg |
| 2           | Y      | 688     | 695     |
|             | Z      | 192     | 207     |
|             | Weight | 1.4 kg  | 2.39 kg |
| 3           | Y      | 958     | 965     |
|             | Z      | 183     | 197     |
|             | Weight | 1.8 kg  | 3.03 kg |
| 4           | Y      | 1268    | 1275    |
|             | Z      | 208     | 207     |
|             | Weight | 2.26 kg | 3.78 kg |
| 5           | Y      | 1528    | 1535    |
|             | Z      | 212     | 203     |
|             | Weight | 2.65 kg | 4.4 kg  |
| 6           | Y      | 1838    | 1845    |
|             | Z      | 298     | 207     |
|             | Weight | 3.11 kg | 5.15 kg |
| 7           | Y      | 2138    | 2145    |
|             | Z      | 214     | 201     |
|             | Weight | 3.65 kg | 5.87 kg |
| 8           | Y      | 2438    | 2445    |
|             | Z      | 210     | 297     |
|             | Weight | 4.0 kg  | 6.59 kg |
| 9           | Y      | 2748    | 2755    |
|             | Z      | 216     | 199     |
|             | Weight | 4.46 kg | 7.34 kg |
| 10          | Y      | 3058    | 3065    |
|             | Z      | 238     | 237     |
|             | Weight | 4.92 kg | 8.08 kg |
| 11          | Y      | 3358    | 3365    |
|             | Z      | 218     | 197     |
|             | Weight | 5.37 kg | 8.8 kg  |
| 12          | Y      | 3688    | 3675    |
|             | Z      | 208     | 237     |
|             | Weight | 5.83 kg | 9.55 kg |

## Technical information



## Materials

|    |  |                 |   |
|----|--|-----------------|---|
| 1  | Separator  | Shell           | Stainless steel 304 (S14 / S11)*  |
|    |  | Internals       | Stainless steel 304 S11*  |
| 2  | Lance  | Body            | Stainless steel BS 3146 ANC3B*  |
|    |  | Tracer tube     | Stainless steel 304L*   |
|    |  | Main tube       | Stainless steel 304L*   |
|    |  | End cap         | Stainless steel 304 S11*  |
|    |  | Spring clips    | Stainless steel 304 (S14 / S11)*  |
| 3  | Nozzles  |                 | Stainless steel – standard*   |
| 4  | Pipe fittings  | Malleable iron* |   |
| 5  | Compression fittings                                 |                 | Bright zinc plated mild steel   |
|    |  |                 | Optional stainless steel 316L   |
| 6  | Pre-heat tracer pipe 8mm O / D tube                  |                 | Spirax Sarco or customer to supply  |
| 7  | Name plate   | Aluminium       |   |
| 8  | Actuator   |                 | See specific installation and maintenance instructions for model supplied |
| 9  | Valve  | LE31 and LE33   | CI DIN 1691 GG25  |
|    |  | KE63            | Stainless steel DIN 17445 4581  |
| 10 | Tracer system  | MST21(E)        | Stainless steel   |
| 11 | Lance interconnecting pipework – installer to supply |                 |   |
| 12 | Escutcheon plates                                    |                 | Galvanised steel  |
| 13 | FT14 drain trap                                      |                 | SG iron EN 1563 EN-GJS-400-15   |

## Assembly information

Where Spirax Sarco supply the steam control equipment, the separator and valve would be dispatched assembled. Alternatively, the separator, valve and actuator can be dispatched fully assembled when requested, to simplify final installation.

Actuators can be pre-commissioned if the control signal is known. When the steam control is not part of the humidifier order, the piping components will be supplied partly assembled to the separator, for final assembly by the installer.

The separator and each lance are supplied with 2 x 8 mm O / D tube compression fittings (5):

- 1 for the tracer supply take-off from the top of the separator,
- 1 each for the inlet and outlet connections for the lance heating circuit and
- 1 for the inlet to the tracer drain trap (10).

A Spirax Sarco balanced pressure thermostatic trap (10) type ¼" MST21 (E) should be used for this application.

The preheater in the lance can be supplied with steam direct from the separator at the using steam pressure as shown, or alternatively from an independent source up to a maximum of 4 bar g.

The separator drain (Q) should be fitted with a Spirax Sarco float trap (with automatic air vent) to continuously discharge collected condensate.

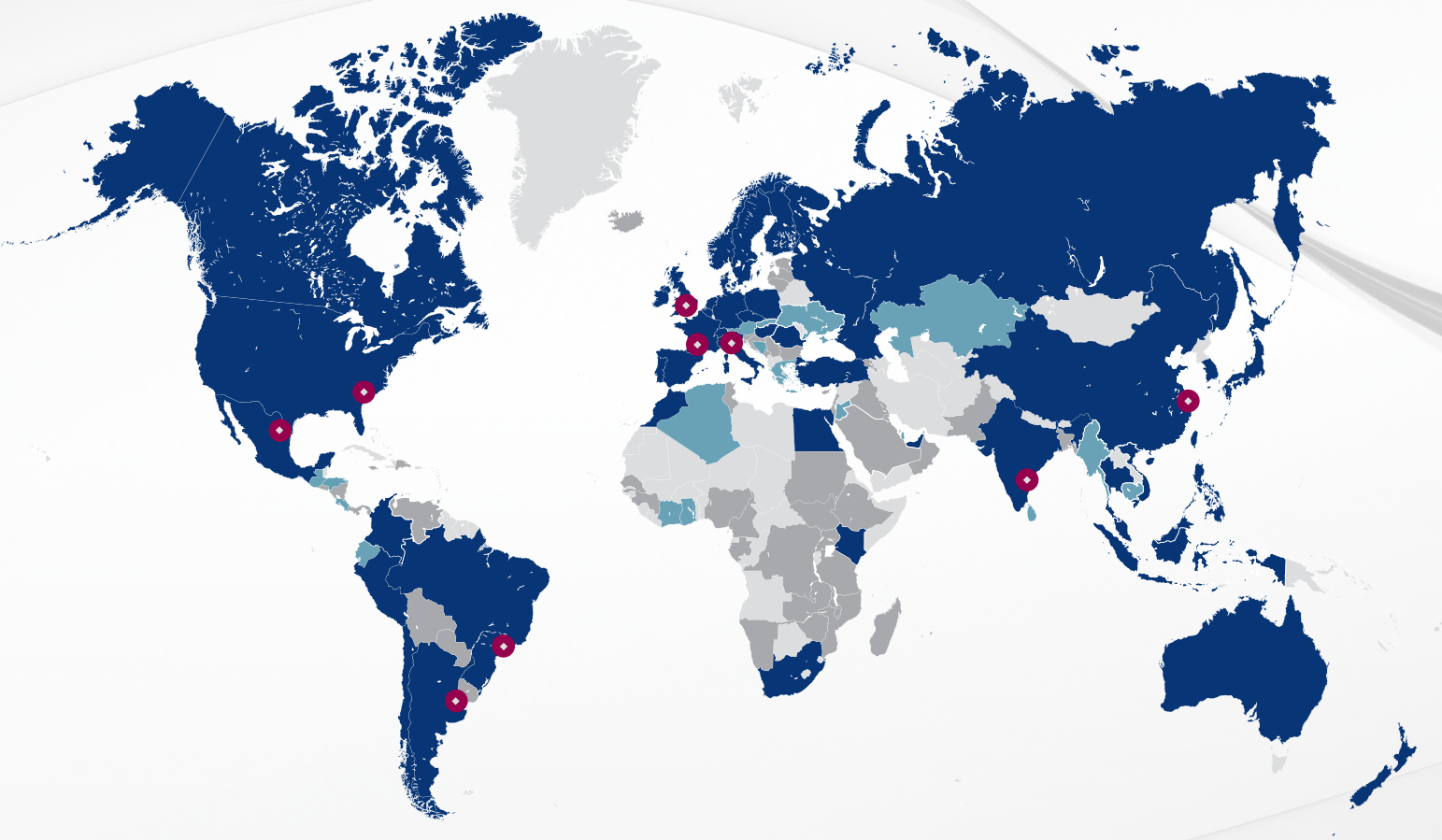
## Typical specification

The humidifier shall be a Spirax Sarco S.I. type of the direct steam injection design, having a stainless steel twin section separator with internal cyclonic and baffle moisture separation to provide dry saturated steam.

The injection lance in stainless steel shall be steam preheated, and utilise stainless steel nozzles.

The control valve shall be a Spirax Sarco 2-port valve with a spring reserve electric actuator suitable for a 24 Vac supply.

Some of the products shown may not be available in certain markets.



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