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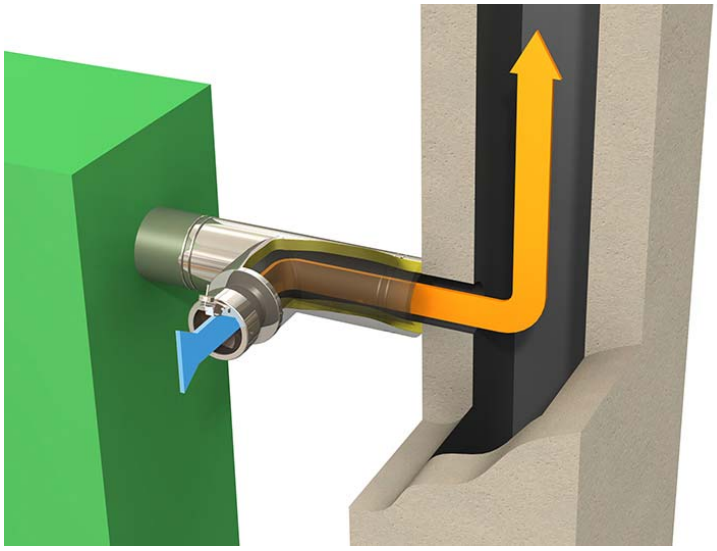
AN SPX BRAND

Importance of a Draught Regulator



The purpose of a chimney (stack) is to generate a draught (draft) that will transport smoke and fumes away from the point of combustion. The chimney design and arrangement of parts are of great importance in achieving an efficient heating system. The draught in the chimney is determined by outside air temperature, boiler (or furnace) capacity, exhaust gas temperature, chimney height and outside wind conditions. As conditions change with the seasons, the draught can easily vary from 0 to 100 Pa. Solid fuel boilers are most efficient when the negative pressure in the chimney ranges from 0 to 20 Pa. Irrespective of whether burning oil, wood or pellets, a stable draught is of great importance.

A large number of domestic boilers that are sold today are replacements for older heating installations. They are often connected to old chimneys and/or chimneys with insufficient insulation. These older chimneys often have an open area that is too large for today's modern and efficient boilers. When changing from oil heating to wood or pellets, the problem is often the opposite since smoke gas volumes increase when burning solid fuels, demanding a larger area.

Heating installation

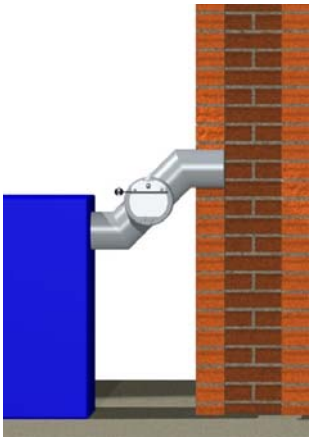
How a heating system is installed will have great impact on reliability, overall efficiency and on the environment and should therefore be installed for optimal performance. It is important that the three main components; boiler, burner and chimney are suitable and work well together. The Chimney often receives the least amount of attention despite the fact that discrepancies in design or dimensioning could lead to serious problems.

Chimney system

The height of the building often determines the chimney dimensions. On warm days with no wind, chimney heights lower than 4 meters can lead to burner start-up problems due to a high resistance in the chimney. The area in the chimney channel must be dimensioned using height, capacity and energy source. Consult with your boiler or burner supplier. The correct chimney area is essential for problem-free operation.

Too small of an area in the chimney will lead to increased resistance (friction). This is especially sensitive during burner start-up since the chimney is still cold. Resistances in the channel causes the burner to start with increased soot, or in worst case, not start at all. An overly large chimney area will lead to a slow exhaust gas velocity. In this case, smoke gases cool down before they reach the end of the chimney, resulting in condensation.

When installing a new boiler, place the boiler as close as possible to the chimney. The flue pipe between the boiler and chimney should be done with as few soft bends as possible. Bends always worsen the draught and make it more difficult to remove soot. Changes in area should be made as gradual as possible. Since draught is proportional to mean temperature in the chimney, it is important to maintain a stable temperature to the chimney top.



Water condensation

Condensation will form if the exhaust gas temperatures are too low before they leave the chimney. The condensation that runs along the inside walls of the chimney consists mainly of water, but also contains corrosive acids. This is extra sensitive in a brick chimney since condensation leads to erosion, cracks from freezing and leakage. Even acid resistant piping is influenced by condensation. The dew point (temperature at which steam in smoke gas starts to condensate) at proper draught conditions is 45°C for pellets, 47°C for oil and 57°C for natural gas (at 13% CO_2). The dew point temperature varies depending on CO_2 content - the lower the CO_2 content, the lower the dew point.

Since the material in the chimney maintains a lower temperature than the exhaust gas, the exhaust gas should have a temperature of at least 10°C over the dew point temperature measured at 0,5 m down from the top of the chimney. In older, non-tight boilers with high smoke gas temperatures, and that also have burners unequipped with a self-closing damper, the CO_2 content in the exhaust gas is often low. This means the risk for condensation in such installations is lower, however energy consumption and the negative influence on the environment are much higher compared to new heating installations.

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Condensation in the Chimney

Condensation in chimneys can occur due to a number of various factors. Modern boilers have optimal thermal efficiency ratings with low exhaust temperatures and high CO_2 content. The design and requirements on small easily installed boilers have lead to reduced water volumes in boilers. Reduced water volume leads to less running time of the burner, which in turn always leads to increased condensation.

New burners with self-closing dampers and new tighter boilers are helping to reduce losses as air flows through the boiler, which in itself improves efficiency over the year. This however, removes a degree of ventilation in the chimney that existed before, which creates a large risk for condensation only by changing burners. There is also a large risk for condensation on chimney installations that were done originally for an older boiler, as the area measurements are most often incorrect for the new and much more efficient boiler.

What can be done to prevent the risk of condensation in chimneys?

1. Always install a draught regulator. The Draught Regulator allows dry air from the boiler room to enter the chimney. This provides a certain amount of dilution to the exhaust gases during operation, which increases exhaust gas circulation and decreases the dew point by approx. 10°C. This also provides a certain amount of drying while the burner is in stand by position.

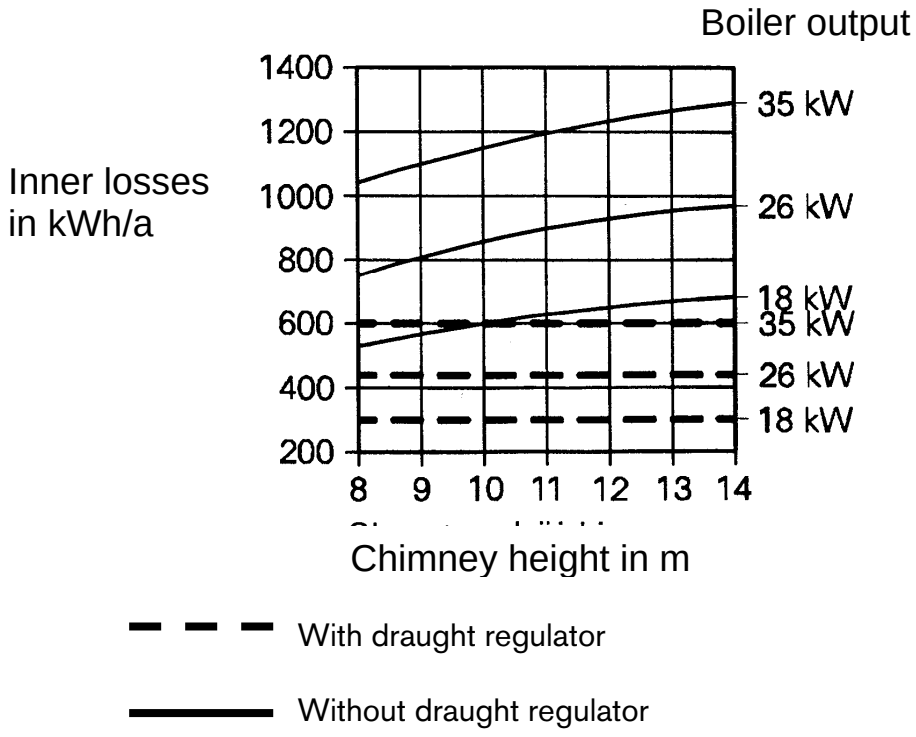
2. In a test conducted on a domestic boiler, the turbulators were removed. The input power was increased from 22 kW to 27 kW and exhaust temperatures were measured at over 300°C. Nevertheless, there was still condensation in the chimney after the heating unit had been running for 5 minutes. The same boiler with all the turbulators in place, with an input power of 22kW, exhaust temperatures of 180°C and a draught regulator installed had no condensation in the chimney after the heating unit was running for 1.5 minutes. Thus, the exhaust temperature is less important than the running time and draught regulator in reducing the risk of condensation.

3. Insulate the connection pipe between the boiler and chimney as well as any portion of chimney pipe that passes through an open or cool area.

4. The most secure solution is to install a correctly dimensioned stainless steel pipe in the chimney in combination with a draught regulator. Installing only the stainless steel pipe without a draught regulator would make it impossible to regulate stable combustion conditions in the burner chamber throughout the year. Not using a draught regulator makes it difficult to avoid condensation in the chimney pipe. Different seasons throughout the year place different requirements on the heating installation. From time to time the burner runs at very short intervals, which increases the risk of condensation in the chimney resulting in corrosion to the pipe.

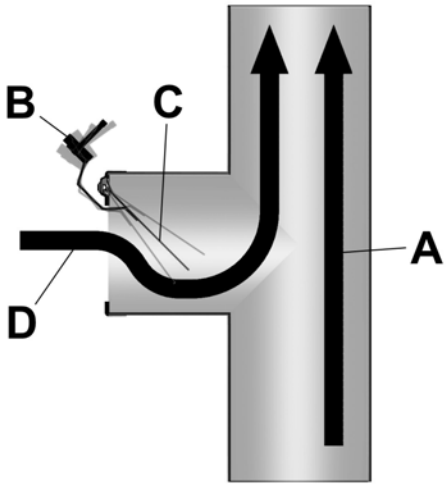
The importance of draught Regulators in efficiency and reliability

The draught regulator is very important for boiler reliability and fuel efficiency. Irrespective of whether the boiler is fired with oil, gas, pellets or wood, a stable draught in the chimney is important for combustion conditions in the burner chamber. Draught variations in the chimney influence velocity of the exhaust through the boiler, which effects heat exchange. When burning solid fuels with too high of a draught, the time for carburetion and contact with the heat exchanger are too short, which leads to low thermal efficiency, poor combustion and eventually problems in operation. Weather and wind conditions vary drastically over the period of a year, which changes the conditions in the chimney. On cold days with high wind conditions, the draught increases and on calm, warm days there may be no draught at all. This leads to different draught conditions inside the fire chamber as the burner fan will give different amounts of air depending on the conditions. A properly dimensioned and correctly installed draught regulator allows only the necessary amount of combustion air to pass through the boiler resulting in the optimal efficiency rating.



The diagram above shows the difference in inner losses on systems installed with and without a draught regulator. The biggest energy losses arise however in installations without draught regulators due to increased soot build up, breakdowns and unburned particles. We can read from the diagram above that a heating installation with boiler capacity of 35 kW, chimney height 12 m will suffer Inner losses without a draught regulator of 1.240 kWh/year. The same installation with draught regulator only suffers losses of 600 kWh/year. Experience has shown that the total savings for an installation with a draught regulator is between 2-7 %.

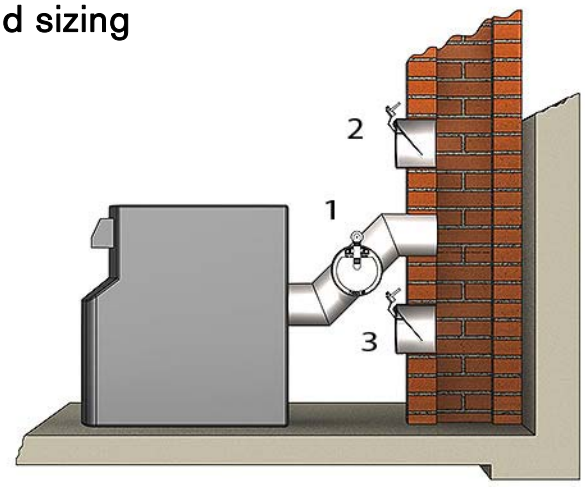
The draught regulator regulates the draught in the chimney by the pressure difference between the chimney and the environment (air that flows in from the boiler room to the chimney keeps the draught in the chimney pipe and the fire chamber stable). If a heating installation for oil does not have a draught regulator, there is a risk that the draught in the boiler will be so strong that the oil burner is unable to start when it is really cold outside. In the same way, if an oil burner is tuned on a cold day, the risk is that the draught is too low during the warm periods resulting in soot build up. It is the same result with pellet burners. All boilers should have draught regulators to compensate for the different draught conditions throughout the year. This means that irrespective of what time of year the burner is serviced, the set burner values are unchanged during the whole year, resulting in increased reliability and fuel efficiency.



A Exhaust gas
B Counter weight
C Adjusting plate
D Air from boiler room

Draught regulator placement, setting and sizing

The optimal placement depends mainly on the task it must fulfil. Possible placements include; on connection pipe directly after the boiler via an adapter for round pipes (Pos.1), just before chimney (Pos.2). It is possible to build it in the brickwork above the boiler (Pos.3) or under the chimney pipe (Pos.4). Special adapters must be used in the latter two cases for building into brickwork. Tigerholm has a wide range of adapters for our draught regulators that fit directly to most existing soot doors on the market.



By adjusting the counter weight, the draught regulator can be set to open at different negative pressures. An instruction sheet, included with every draught regulator, shows how many mm to adjust per Pa (negative pressure). All Tigerholm draught regulators are factory adjusted to 10 Pa. The typical value for a home installation is 10 Pa for over-burning, oil and gas boilers. Standard values for other boilers like ceramic and under-burning boilers are 17-25 Pa.

The size of the draught regulator is of vital importance for proper function of the heating installation. The chimney height, chimney area, capacity and fuel type are crucial in determining the correct size. In order for the draught regulator to function properly over the entire heating season, the amount of air that passes through the draught regulator must be suitable when the temperature is – 20°C. The table below is valid for solid fuels. The capacity can be increased by approx. 20% when burning gas or oil.

Model	Capacity	Max. height	Max. chimney dia./area
Tigex 25	**< 25 kW**	**< 8 m**	**∅ 125 mm/169 cm^2**
Tigex 50	**< 100 kW**	**< 14 m**	**∅ 200 mm/338 cm^2**

On borderline cases we recommend installing the next size up or two draught regulators. In the case of two, draught regulator No. 1 should be installed at a negative pressure of 10 Pa and No. 2 so that it opens when No. 1 is maxed out. This must be adjusted on site. The recommended setting on draught regulator No. 2 is 25 Pa.