



## OPERATION AND MAINTENANCE MANUAL -----

For type boiler below

| BOILER<br>TYPE           | BOILER<br>OUTPUT<br>kW. | PRESSURE<br>COMBUSTION CHAMBER<br>mb. | BURNER<br>INPUT<br>Kw(hs). |
|--------------------------|-------------------------|---------------------------------------|----------------------------|
| WND 0.50 / WND-LD 0.50   | 580                     | 3.0                                   | 700                        |
| WND 0.75 / WND-LD 0.75   | 870                     | 3.5                                   | 1050                       |
| WND 1.00 / WND-LD 1.00   | 1160                    | 3.5                                   | 1400                       |
| WND 1.25 / WND-LD 1.25   | 1450                    | 3.5                                   | 1750                       |
| WND 1.50 / WND-LD 1.50   | 1750                    | 4.0                                   | 2113                       |
| WND 2.00 / WND-LD 2.00   | 2350                    | 4.0                                   | 2838                       |
| WND 2.50 / WND-LD 2.50   | 2900                    | 4.5                                   | 3502                       |
| WND 3.00 / WND-LD 3.00   | 3490                    | 4.0                                   | 4215                       |
| WND 3.50 / WND-LD 3.50   | 4070                    | 4.0                                   | 4915                       |
| WND 4.00 / WND-LD 4.00   | 4650                    | 5.0                                   | 5615                       |
| WND 5.00 / WND-LD 5.00   | 5800                    | 5.5                                   | 7004                       |
| WND 6.00 / WND-LD 6.00   | 6980                    | 6.0                                   | 8430                       |
| WND 7.00 / WND-LD 7.00   | 8140                    | 6.5                                   | 9830                       |
| WND 8.00 / WND-LD 8.00   | 9300                    | 7.0                                   | 11232                      |
| WND 9.00 / WND-LD 9.00   | 10450                   | 7.5                                   | 12620                      |
| WND 10.00 / WND-LD 10.00 | 11630                   | 8.0                                   | 14045                      |
| WND 11.00 / WND-LD 11.00 | 12793                   | 8.5                                   | 15050                      |
| WND 12.00 / WND-LD 12.00 | 13630                   | 9.0                                   | 16460                      |

## **1. GENERAL**

### **1.1 Introduction**

The boiler you have just purchased is a product of unparalleled technical engineering and superb quality, expressly designed with the consumer in mind. Our considerable experience in the building of boilers serves as a guarantee of excellence and long life assurance, meeting both the requirements of the client and the high standards demanded by our firm. We wish to point out that careful maintenance considerably extends the lifespan of your boiler and that the warranty received on delivery is dependent on the application of our guidelines as outlined below. We therefore recommend that you exercise care and caution in the reading of the operation and maintenance manual prior to the utilisation of your boiler, and follow-up on the recommendations accordingly.

We wish to draw your attention to the fact that not only the assembly instructions but also the Nuisance Act, the law concerning Public Safety and Security, the Steam Act and the provincial and local regulations should be taken into account to the extent they are applicable.

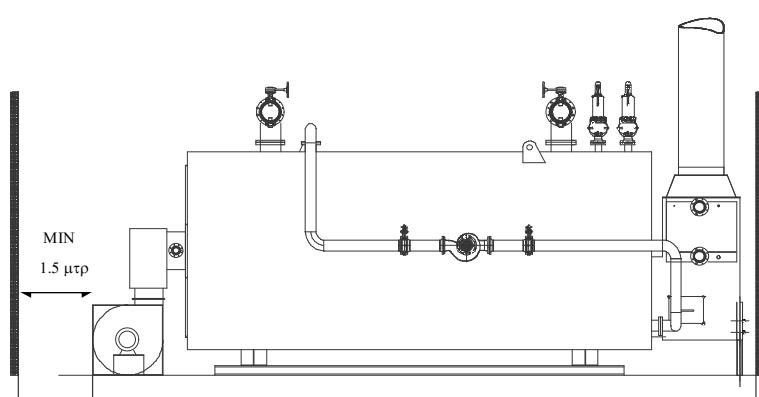
### **1.2 Warranty**

The warranty period is 24 months from the date of delivery. It is imperative we be notified of any damages covered by the warranty within 24 hours. The warranty is only applicable during boiler usage and contingent upon the observation of the below outlined operation and maintenance guidelines and compliance with the regulations imposed by government. A copy of the latter has been supplied to you upon purchase of your boiler. Should this document NOT have been provided, please forward a request us for a duplicate to be sent (as well as a copy of our General Conditions).

If the boiler is in need of repair as a result of *either* superheating due to water shortage, incorrect burner adjustment, and / or soiled heat-transferring elements of the water connection, *or* an outside-interference such as the burner, an explosion, flood, etc., we are unable to offer a warranty in the instance whereby a boiler is repaired without our written consent.

## **2. THE BOILER HOUSE**

**2.1** The boiler must be positioned in a boiler house unless placed in a manufacturing area (e.g. a workshop). This area, however, must not be subject to fire hazard or explosion resultant in damage to the boiler



**2.2** In the case of spatial constriction within the boiler house, a soot cleaning door opposite the smoke box door of the boiler will need to be constructed to enable the cleaning out of the fire tubes. If this, for constructional reasons, is impossible, one can, alternatively, employ a hinging soot-brush rod.

**2.3** The distances between the boiler(s) and the walls should be sufficient for the assembling and dismantling of the burner, pumps, etc.

**2.4** At all times should one be able to easily and safely exit and enter the boiler house area.

**2.5** Through the means of fixed fittings, the boiler house and work place must be appropriately and sufficiently lit conducive to a suitable work environment under the absence of natural daylight. It is advisable that an electric switch be in an easily locatable position and in proximity to the stoke installation to turn the burners off if necessary. Lighting may not be connected to the same fuse

box as the stoke installation.

**2.6** In most cases, a boiler house floor with a thickness of 10-12 cm as well a light double-reinforcement should be more than sufficient.

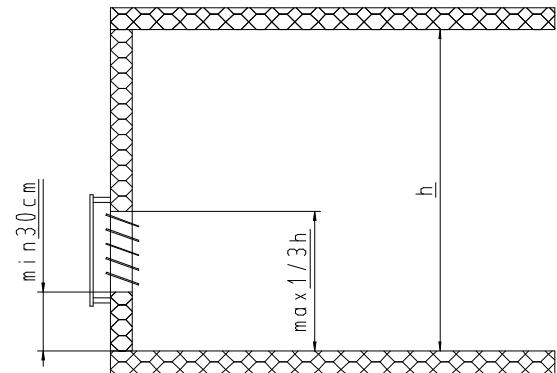
**2.7** A drain should be in-built in the flooring to facilitate the discharge of scrub water, etc..

**2.8** The supply of air for combustion and ventilation:

2.8.1 The supply opening should not be placed at a level higher than one-third of the height of the boiler house. The bottom side of the grate should not be positioned lower than 30 cm from the boiler house floor.

2.8.2 The supply of the combustion air may be distributed over various openings. All openings should collectively be in possession at least one free passage.

2.8.3 It should not be possible to close the supply openings.



**2.9** The discharge of ventilating air:

The boiler house should be sufficiently ventilated at all times in order to discharge possible leakages and / or vapours, and to maintain the requisite temperature during the stoking season (preferably between 10°C and 30°C).

2.9.1 The discharge outlet opening should be positioned as high as possible, at least at a level of two-thirds of the total height as measured from the floor.

2.9.2 The discharge may be distributed over various openings. All openings should collectively be in possession of at least one free passage.

2.9.3 It should not be possible to close the discharge outlets. Such is not applicable to additional openings discharging generated heat.

2.9.4 Supply and discharge openings should be positioned in a manner conducive to the boosting of cross ventilation.

**2.10** In certain incidences, it is advisable to lead the combustion air through a pipe connected to the ventilator inlet to the boiler. In this event, sufficient ventilation must be sustained.

**2.11** Gas supply should be closed *automatically* in the instance of a ventilator break-down during *mechanical* supply of combustion and ventilating air to the boiler house.

### **3. THE FLUE**

**3.1** Our firm will inform you of the flue diameter. In general, the flue can be of a diameter similar to the condenser's connection flange.

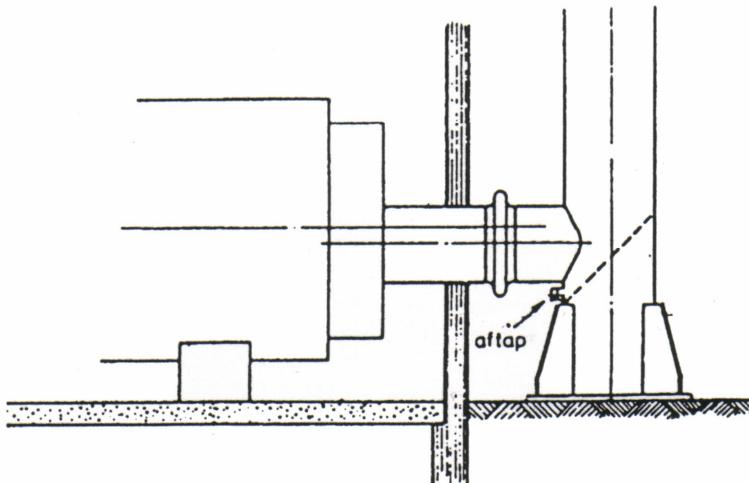
**3.2** The flue height depends on the particular conditions of the location. In most cases a height of 6-8 m should be sufficient. The flue will need to be supported and secured with guys.

**3.3** If the flue is not directly placed on the boiler, flue gas should be directed to the chimney in question.

**3.4** The flue may be positioned inside or outside the boiler house. The connection outside the boiler house should be insulated. In addition, a draining aperture (diameter:  $\frac{1}{2}$ ") should be created on the bottom side of the flue for the purposes of rainwater drainage and condensation.

**3.5** The condensation of gases is preventable through the construction of double walls or insulation of the flue.

**3.6** In the instance whereby boilers are placed alongside each other, it is preferable that each boiler possesses its own flue. If a common flue is used for all boilers, one or more partitions should be placed in the flue to an approximate height of 6 meters.



#### **4. FEED AND BOILER WATER**

##### **4.1 Feed Water**

Water can contain elements that cause scale or may be of a corrosive nature. Prior treatment is therefore recommended when planning to use as feed water. Scale is formed by hard water. Certain scale types may effect such a heat-transferring restraint sufficiently severe to damage one or more fire tubes and the fire passage.

Water's corrosive nature is predominantly caused by the presence of oxygen and / or free and bound carbon dioxide. Feed water must be treated in such a manner that hardness and the presence of oxygen and bound carbon dioxide is limited. Feed water, ideally, should contain no hardness as certain types of scale are extremely difficult to remove once formed.

Feed water hardness depends on the hardness of the make-up water (treated tap-water) and the percentage of added condensate. The hardness of the make-up water is contingent on the method of hard water treatment. Consequently, it is of the utmost importance that the directions for the water treatment installation (should such be present) be followed as accurately as possible.

Feed water criteria are set by our organisation as per the following :

|                     |   |                 |
|---------------------|---|-----------------|
| - hardness          | : | max. 0.1°D      |
| - pH at 25°C        | : | min. 9          |
| - oxygen            | : | max. 0.1 mg/kg  |
| - oil               | : | max. 1.0 mg/kg  |
| - Cu                | : | max. 0.1 mg./kg |
| - Fe                | : | max. 0.3 mg/kg  |
| - KMnO <sub>4</sub> | : | max. 10 mg/kg   |

##### **4.2 Boiler Water**

The make-up water contains dissolved salts entering the boiler with the feed water. The steam produced transports virtually no salts. A thickening of the storage water consequently occurs,

leading to an increased salt concentration, alkalinity and silicate content. Concentration of salt and alkalinity can result in ebullition and foaming of the boiler water, while an increased silicate content results in scaling on hot boiler components. It is therefore of the utmost importance to execute drainage on a regular basis to ensure that the boiler water meets the standard requirements. The percentage of water to be drained is contingent on the percentage and composition of the make-up water.

Storage water must meet the following requirements:

|                    |   |                  |
|--------------------|---|------------------|
| - conductivity     | : | max. 6,000 uS/cm |
| - solid content    | : | max. 4,000 mg/kg |
| - p-alkalinity     | : | 2½-12 mval/kg    |
| - P205             | : | 5-10 mval/kg     |
| - SiO <sub>2</sub> | : | 10 + 7 P mg/kg   |
| - pH               | : | 10½-12           |

The above mentioned criteria for both feed and boiler water should be checked on a regular basis. Analytical instructions are outlined in the Dutch NEN 3130 'Methods to analyse boiler water'.

#### **4.3 Recommendations**

For boilers with a pressure higher than 2 bar, feed temperature should exceed 80°C so as to avoid aggressive upsurges induced by lower temperatures. This is unconnected to the quality of the feed water.

In boilers with a pressure of 0.5 bar, it is recommended that feed or recycled water be introduced at a temperature of at least 70°C to prevent thermal stress and, consequently, extend the lifespan of the boiler.

Following a working period of one month, it is recommended that the boiler be fully drained and the water connections cleaned. Please note that draining does not remove hammer and mill scale - large amounts may be found at the bottom of the boiler shell.

Various well-established firms can provide service contracts managing the treatment and purification of water. The condition of the water is analyzed and advice furnished accordingly.

It is strongly advised to execute drainage on a frequent basis, with particular attention paid throughout the initialisation period. The blow-off tap must be opened for a minimum duration of 10 seconds on each occasion.

#### **5. FILLING THE BOILER**

- 5.1** Prior to filling of the boiler, feed water must be analyzed as confirmation that all criteria under paragraph 4.1 are met in their entirety.
- 5.2** Through the means of a feed pump, fill the boiler to a third, as can be noted in the gauge glass. Consult the operation manual of the pump manufacturer.
- 5.3** Ensure that sufficient de-aeration takes place during the filling procedure. We recommend that the assembly of one of the connections on top of the boiler be postponed until such time as the heating unit has been filled. In this manner the boiler is adequately de-aerated throughout the filling process and the spring-loaded safety mechanisms are only utilised upon the operation of the installation.  
De-aerate can be achieved via the manometer or, alternatively, one of the two gauge glasses should a de-aeration valve not be present. In this case, all water connections should be closed and the steam and drain connections opened.
- 5.4** In order to assure the complete filling of the installation, please ensure that all water connections are open during the filling procedure. Upon completion of the process, water connections that should not remain open can be closed.

**6. STOKING THE BOILER**

- 6.1** Verify that all man and mud holes of the boiler are closed. Establish whether a free outflow of gases via the flue is guaranteed.
- 6.2** Heating should occur gradually. It should take 2 to 4 hours to compress the boiler under a low non-varying burner capacity from cold in order to avoid excessive thermal stress resulting from large temperature discrepancies. The burner flame should remain on 'low' throughout the entire initialisation period.
- 6.3** Water expansion occurs during the heating period, elevating the water level in the boiler. On discharging through continuous drainage, gauge glasses should not be filled in excess of 3/4.
- 6.4** Boiler pressure will increase by gradual degrees. Heating should be by low flame until the operating pressure is reached and boiler water is homogenously heated. This can be verified by checking the drainage tube which should feel hot.
- 6.5** When heating from cold, particularly in the usage of natural gas, much condensed water from flue gases will form on cold boiler surfaces. The condensate can be tapped using the condensation draw-off tap on the smoke box at the rear of the boiler. Condensation no longer occurs at a temperature of 60°C and the draw-off tap should be closed.
- 6.6** The maximum operational pressure for the installation should be set at 0.5 bar. The maximum temperature is 110°C.

**7. INITIALISING BOILER OPERATION (HIGH-PRESSURE BOILERS)**

In order to prevent unnecessary heat loss, it is required that the boiler be insulated prior to initialising its operation, simultaneously securing safer conditions in which to work on the boiler. The manufacturers cannot be held responsible in the event of the boiler not being insulated prior to the initial stoking procedure.

- 7.1** The main steam pipe should be preheated and de-watered to the nozzle prior to placing the boiler on the network. For this purpose, either the bypass valve around the main steam valve, or the main steam valve if no bypass valve is present, should be opened slowly. To ensure the successful introduction of network and steam, the boiler pressure should be slightly higher than the network pressure during the change over.

Fuel, air, level, temperature, pressure, supply, electricity and condensation levels may be set on automatic as long as all relevant regulations are conformed with.

When applicable, the continuous drain should be set in accordance with the water quality.

- 7.2** Owing to pressure exerted on the boiler, man holes and bolted flanges may spring leaks. In such an event, tighten the bolts in a criss-cross manner, fastening clamps on the front doors as well as the capped nuts of the cleaning hatch to the rear in a similar fashion, should it prove necessary.
- 7.3** The water should be maintained at an average level when the boiler is in operation. The water level may not fall below the Lowest Permitted Level (LPL) as indicated on the gauge glasses and should be increased through addition should it drop below. If such, for whatever reason, proves impossible, the burner should be halted and secured by means of the first or second safety electrode set at 30 mm below the LPL, equivalent to 20 mm on the gauge glass.

**7.4** Under no circumstances should the steam pressure exceed the computed pressure.  
The latter is indicated on the punch plate in addition to being marked with a red stripe on the manometer. Excess will result in the activation of Safety devices. The condition and workings of safety devices require regular inspection. No unauthorised alteration of the charge settings on these apparatuses is permissible. Overburdening or deactivation of the devices is considered a serious breach of the Steam Act. In principle, the burner is halted and secured by the max. pressure-stat.

**7.5** High quality feed water is a primary precaution for trouble-free boiler operation. Frequent analyses are consequently rendered of the utmost importance and water quality should be adjusted to meet the set criteria.

**8. CIRCULATION / SHUNTING**

**8.1** Large capacity boilers, such as those principally employed by companies cultivating under glass, comprise circulation circuit pumps to equalize boiler water temperature in so far as possible.  
  
Your boiler has been supplied with an optimal circulation pump and shunt pipe for maximum efficiency. The shunt pipe is positioned at the bottom end of the boiler, covering the entire length and featuring multiple holes on either side.

**8.2** In order to stimulate the natural rise of water (and thereby the circulation of boiler water), the warm water is introduced from the bottom of the boiler.

**8.3** Connection to the circuit may occur in various ways. We do, however, advise that you consider this as a separate circuit and bear this in mind on connecting the circuit - for example by leading the warm water through the supply nozzle to the shunt pipe at the bottom of the boiler.

**9. BOILER INSPECTION AND MAINTENANCE**

**9.1** Inspection of the deaerated gas temperature (only for low-pressure steam and warm water boilers)  
The deaeration temperature must be checked regularly. The normal deaeration temperature is approx. 180 °C. Fire tubes must be cleaned out should the temperature exceed 200 °C. Fire tubes are to be cleaned sooner if oil rather than gas is used as fuel. The flue gas thermometer can be checked periodically by dipping the feeler into boiling water (100 °C).

**9.2** Connection to the system and boiler temperature limitation (only for low-pressure steam and warm water boilers)

It is not permitted to modify the connections or fit additional connections without the consent of the manufacturer. A shunt pump with a capacity of double the water contents of the boiler must be positioned between the existing connections. A blocking thermostat must be incorporated to prevent the cooling of boiler water below 70 °C. The blocking thermostat can be connected so as to prevent further cooling (e.g. through closure of the mixing valves). Safety devices need to be constructed to the connections present on low-pressure boilers. These safety devices should be of a capacity disallowing the maximum permitted static pressure of 3.5 bar to be exceeded.

**10. DAILY INSPECTION**

- 10.1** Both the water level within, and the pressure on the installation, are to be inspected on a daily basis.
- 10.2** Gauges should be drained twice daily :- Set the control current switch at 0 and close valve B. Open valve C for a few seconds. Follow by resetting B and C to operating positions.
- 10.3** Water gauges must also be drained twice daily:- Set the control current switch at 0 and close valve B. Open valve C for a few seconds. Reset B and C in operating positions. Close valve A, open valve C for a few seconds. Subsequently, reset A and C to operating positions. Mud drainage must be confirmed via sight-glass D, during the drainage process. The control current switch must be set back in the operating position.
- 10.6** It is important that valves and taps are fully opened upon drainage of various components. Blockages in pieces of pipe or fittings must be cleared immediately.
- 10.7** Drain boiler through discontinuous-drain. Analyse boiler and feed water, adjusting accordingly should the requirements in chapter 4 of this manual not be adhered to.
- 10.8** Consistently check the water level in the feed-tank or deaerator.

*Note: In respect of burner daily maintenance, please refer to the operation and maintenance manual of the relevant supplier.*

**11. WEEKLY INSPECTION**

- 11.1** The maximum-thermostat requires a weekly check. Ensure the thermostat's adjustment knob is turned to a temperature lower than that of the boiler. The burner must stall and malfunction. Reset the thermostat to the original temperature.
- 11.3** The safety devices are to be examined weekly through careful manual lifting of the lever.
- 11.4** On a weekly basis, inspect the masonry in front of the fire passage for cracks and evidence of crumbling. The inspection can be executed through the sight-glass to the rear of the burner upon lighting of the flame. Damages should be rectified forthwith to avoid burning of the boiler front and burner cone.

**12. MONTHLY INSPECTION**

- 12.1** Repair all leaking flanges, fittings and tubes or provide with new gaskets.
- 12.2** Open the front door and check the pipes for leakages by means of brushing. Remove any soot present.
- 12.3** Automatic regulations to be inspected by a third party.
- 12.4** Check and clean low-level safety electrodes on scale.
- 12.5** Ensure that electrodes do not leak upon fixing to the flange.
- 12.6** Clean the feed pump switch (remove mud, etc.).
- 12.7** Clean the necessary filters.

**13. ANNUAL INSPECTION**

- 13.1** Empty the boiler and clean the water- and flue gas connections annually.
- 13.2** Inspect the boiler interior for scale and whether pitting corrosion has affected the heated components. Should such prove to be the case, water treatment should be improved in consultation with an expert in the field. The boiler should also be inspected for signs of leakage.
- 13.3** Sever scale forming (more than 0.25 mm) should be removed chemically. Again, in consultation with an expert in the field.
- 13.4** Following gasket renewal, all man-, mud- and other inspection lids should be re-assembled and all bolts greased with graphite grease.
- 13.5** Inspect burner masonry for cracks and damages.
- 13.6** In respect of burner maintenance, please refer to the operation and maintenance manual of the pertinent supplier.
- 13.7** Fill and stoke the boiler in conformance with chapters 5 and 6 of this manual.
- 13.8** Following the stoking procedure, re-tighten bolts of relevant inspection holes.

**14. CLEANING THE FLUE GAS CONNECTIONS OF THE BOILER**

- 14.1** The boiler front is equipped with a door to enable cleaning of the flue gas connections. By opening this door, all fire tubes can be inspected and cleaned by means of fire tube sweep-brushes. The soot can be removed via the explosion hatch, the soot hatch in the deaeration house (the condenser), as well as the front boiler door. Examine the door-gasket upon closing the door and replace if damaged. Depending on fuel type and the flame adjustment, cleaning of the flue gas connections on a monthly basis should be sufficient.
- 14.2** Ensure correct adjustment if using oil burners. If inaccurate, cokes will be formed and need to be removed when operating activities have come to a standstill. A correct burner adjustment reduces wear significantly. The need for adjustment can be verified by a regular flame check through the sight glass fitted in the explosion hatch.
- 14.3** In the event of the employment of rotating oil burners, the atomizer shall need to be cleaned on a daily basis (consult manufacturer's directions).
- 14.4** Low-pressure boilers and warm water boilers are usually heated from cold. The relatively cool walls of the surface to be heated, will begin to "perspire" as a result of the condensation of water in the flue gases. Moreover, the possibility of solid sulphur and fly ash deposition may occur on the heated surface. This deposition must be removed from the boiler regularly and thoroughly. Cleaning-specific equipment is available from the relevant distributors. This task can alternatively be contracted out to a reputable firm in the field.

Errors

| Error                              | Cause   | Remedy  |
|------------------------------------|---|---|
| Water run out Door                 | Condensor drain blocked<br>Boiler temperature to low<br>Gasside leakage | Clean condensor drain<br>Check thermostat must be over 65°C<br>Check fire tube /firebox |
| Burner switch off to high pressure | Condensor drain blocked<br>Boiler gasside filthy                        | Clean condensor drain<br>Clean firetubes  |
| Pressure loss                      | Leakage gaskets<br>Leakage Fire tube                                    | Check Gaskets<br>Check fire tubes   |
| Sudden pressure differences        | Expansion vessel filled to high   | Take some water from Expansion vessel   |

### **Checklist yearly maintenance**

- Check Door gasket.
- Control Manhole mud hole gasket.
- Clean water side boiler.
- Burner inspection { burner specialist}
- Smoke box cleaning.
- Condenser Cleaning.
- Syphondrain cleaning.
- Check fire tubes.
- Check safety valves.
- Grease bolts and nuts.
- Clean boiler room.

Boeters Ketel Constructie BV  
Mariendijk 7  
2675 sv Honselersdijk  
Tel 0174-626081  
Fax 0174-627445  
Email [info@boetersbkc.nl](mailto:info@boetersbkc.nl)  
Web [www.boetersbkc.nl](http://www.boetersbkc.nl)