STAINLESS STEEL CONDENSING BOILER

TAU

150 N ÷ 1450 N
150 NC ÷ 600 NC

INSTALLATION, OPERATION, MAINTENANCE AND SYSTEM MANAGEMENT MANUAL

RIELLO

CONFORMITY

RIELLO TAU boilers conform to the Efficiency Directive 92/42/EEC (★★★★), to Gas Directive 90/396/EEC and applicable sections of the Electromagnetic Compatibility Directive 89/336/EEC and Low Voltage Directive 73/23/EEC.

CE 0694

RANGE

MODEL	CODE
TAU 150 N	4031860.0
TAU 210 N	4031861.0
TAU 270 N	4031862.0
TAU 350 N	4031863.0
TAU 450 N	4031864.0
TAU 600 N	4031865.0
TAU 800 N	4031866.0
TAU 1000 N	4031867.0
TAU 1250 N	4031868.0
TAU 1450 N	4031869.0

MODEL	CODE
TAU 150 NC	4031835.0
TAU 210 NC	4031836.0
TAU 270 NC	4031837.0
TAU 350 NC	4031838.0
TAU 450 NC	4031839.0
TAU 600 NC	4031849.0

Dear Customer,

Thank you for choosing a **RIELLO TAU** *stainless steel condensing boiler. You have purchased a quality, high efficiency boiler that will give you dependable and safe service and provide comfort in the home for many years to come. Arrange for your boiler to be serviced regularly by an authorised* **RIELLO** *Technical Assistance Centre. Their personnel are specially trained to keep your boiler efficient and cheap to run. Technical Assistance Centres also stock any original spare parts that might be required.*
This instruction manual contains important instructions and precautions that must be observed to ensure the trouble-free installation and efficient functioning of your **RIELLO TAU** *boiler.*

Please accept our renewed thanks for your purchase.

Riello S.p.A.

On request, your Technical Assistance Centre will also provide you with a system service book. In Italy this is required by Presidential Decree n° 412 of the 26th August 1993. Your Technical Assistance Centre will also be pleased to instruct you how to get the best from your new boiler.

CONTENTS

The following symbols are used in this manual:

⚠ **CAUTION! =** Indicates actions that require caution and adequate preparation

⛔ **STOP! =** Identifies actions that you MUST NOT do

This manual, Code 20014315 - Rev. 11 (02/10) is made up of 44 pages

GENERAL SAFETY INFORMATION

TAU boilers are delivered in separate crates. Check that the appliance is complete and undamaged as soon as you receive it. Report any discrepancies or damage to the **RIELLO** dealer who sold it.

This **RIELLO** TAU boiler must be installed by a legally qualified installer. (In Italy, the law regulating professional installers is Law 46 of the 5th March 1990.) On completion of the installation, the installer must issue the owner with a declaration of conformity confirming that the installation has been completed to the highest standards in compliance with the instructions provided by **RIELLO** in this instruction manual, and that it conforms to all applicable laws and standards.

This boiler must only be used for the purpose specified by **RIELLO** and for which it is designed. **RIELLO** declines all responsibility, contractual or other, for damage to property or injury to persons or animals caused by improper installation, adjustment, maintenance or use.

If you notice any water leaking from the boiler, immediately disconnect it from the mains electricity supply, shut off the water supply, and notify **RIELLO**'s Technical Assistance Service or a qualified technician.

Periodically check that operating pressure in the heating circuit is over 1 bar but below the maximum limit specified for the appliance. If this is not the case, contact **RIELLO**'s Technical Assistance Service or a professionally qualified technician.

If the boiler is not going to be used for an extended period of time, contact **RIELLO**'s Technical Assistance Service or a qualified technician to have the following minimum preparation carried out.
- Switch the appliance OFF at the control panel and mains power switches
- Close the gas cock and heating water cock
- Drain the central heating circuit if there is any risk of freezing.

The boiler must be serviced at least once a year.

This instruction manual is an integral part of the boiler. It must be kept safe and must ALWAYS accompany the boiler, even if it is sold to another owner or transferred to another user or to another installation.

If you damage or lose this manual, order a replacement immediately from **RIELLO**'s Technical Assistance Service.

PRECAUTIONS

The operation of any appliance that uses electrical power demands that a number of fundamental safety precautions be respected. In particular:

Do not allow children or infirm persons to operate this **RIELLO** TAU boiler unsupervised.

Do not operate any electrical devices or equipment, including switches or domestic appliances, etc., if you can smell gas or fumes. If you detect any suspicious smells:
- Ventilate the room by opening all doors and windows.
- Close the gas shut-off cock
- Report the fault immediately to **RIELLO**'s Technical Assistance Service or a professionally qualified technician.

Do not touch the boiler while barefoot or wet.

Never clean or service the boiler without first disconnecting it from the mains electricity supply by turning the main power switch and the control panel switch OFF.

Do not tamper with or adjust the safety or control devices without prior authorisation and instructions from the boiler's manufacturer.

Never pull, disconnect, or twist the electrical cables coming from the boiler even if it is disconnected from the mains electricity supply.

Do no obstruct or restrict the vents in the room where the appliance is installed. Adequate ventilation is essential for correct combustion.

Do not expose the boiler to the elements. It is not designed for outdoor use.

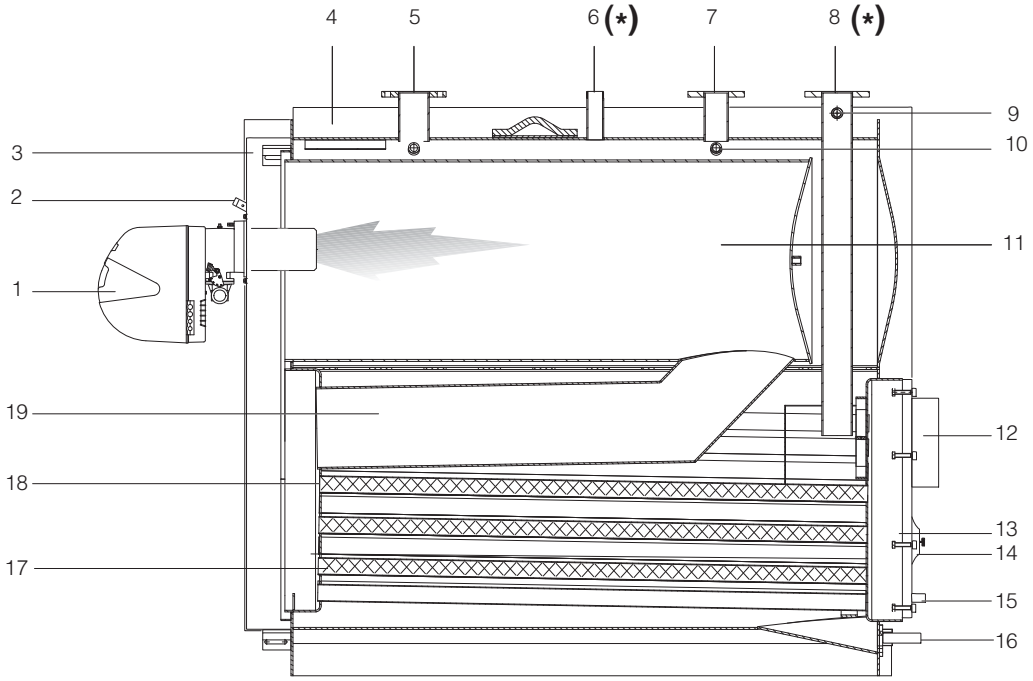
Do not switch the boiler off if outdoor temperature drops below ZERO (risk of freezing)

Do not leave flammable substances in the room where the boiler is installed, even inside proper containers

Do not dispose of packaging material into the environment, or leave it within the reach of children, since it can become a potential hazard. Dispose of packaging material in compliance with applicable legislation.

Le caldaie in acciaio **RIELLO TAU** steel boilers are triple flue pass, condensing boilers for installation in a boiler room. While they are designed primarily for central heating purposes, in conjunction with a suitable storage cylinder they can also be used to produce domestic hot water.
All parts that come into contact with the combustion gases are made from titanium stabilised stainless steel to ensure maximum resistance to the corrosive action of acid condensation.
The boiler has been designed with the combustion chamber at the top and the smooth pipe tube bundle at the bottom to optimise heat exchange and energy efficiency and to maximise the condensing effect.
The boiler has a high total water content which is differentially distributed between its top and bottom sections. This allows outgoing water to reach the set temperature quickly while maintaining the condensing effect and the water heating time around the tube bundle for as long as possible.

TAU boilers feature lightly pressurised combustion chambers for a smoother burner action, and high temperature resistant, stainless steel turbulators inside the tube bundle for maximum burner efficiency.
The boiler body is thoroughly insulated with a layer of high density glass wool.
The paint finished external panelling is also internally insulated with a layer of high density glass wool.
The boiler's front door and the flue gas chamber can be opened completely to facilitate the inspection, maintenance and cleaning of internal parts and to speed up servicing in general.
The front door can open in either direction and can be opened without removing the burner. The door is factory fitted with hinges on the left, but these can be reversed if necessary to suit individual installations.

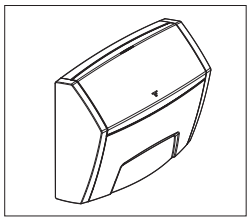


1 - Burner
2 - Flame inspection window with pressure measurement point
3 - Door
4 - Panelling
5 - Outlet
6 - Safety device fitting
7 - Heating return (high temperature)
8 - Heating return (low temperature)
9 - Blind plug
10 - Instrument bulb/probe socket
11 - Combustion chamber
12 - Flue connection
13 - Flue gas box
14 - Inspection door
15 - Condensate drain
16 - Boiler drain
17 - Turbulators
18 - Flue pipes
19 - Second flue pass

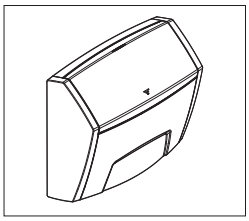
(*) On the TAU 1450 N, the low temperature heating return (8) is located at the rear of the boiler, and the safety fitting (6) is flanged.

CONTROL PANELS

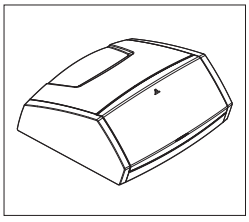
The **RIELLO** control panels that can be used with **RIELLO TAU** steel boilers are listed below. These control panels cater for all the needs of the heating system and of all the devices installed in it.



TECH CLIMA TOP for central heating (1 direct zone and 2 mixed zones) and domestic hot water production with a single stage, two stage, or modulating burner. Also for controlling solar heating system and cascaded boiler systems.



TECH CLIMA COMFORT for central heating (1 direct zone and 1 mixed zone) and domestic hot water production with a single stage burner. Also for controlling solar heating system and cascaded boiler systems.



TECH CLIMA MIX for controlling 1 additional mixed zone.

⚠ When a TECH CLIMA TOP or CLIMA COMFORT control panel is installed, the boiler return (cold) line must be equipped with a temperature sensor socket.

RECOMMENDED BURNERS

The burners recommended to obtain the best possible performance from **RIELLO TAU** boilers are:

BURNER				TAU N-NC						TAU N				ACCESSORIES KIT	
MODEL			CODE	150	210	270	350	450	600	800	1000	1250	1450	BURNER PLATE	LONG HEAD
GAS	TWO STAGE	Gulliver BS 3D	3761716 (*)	•											3001009
		RS 34 t.c.	3789000		•	•									
		RS 44 t.c.	3789100				•								
		RS 50 t.c.	3784700					•							
		RS 70 t.c.	3785100						•						
		RS 100 t.c.	3785300							•	•				
		RS 130 t.c.	3785500									•			
		RS 190	3785812										•		
	MODULATING	RS 34/M MZ t.c.	3788700		•	•									
		RS 44/M MZ t.c.	3788800				•								
		RS 50/M t.c.	3781620					•							
		RS 70/M t.c.	3789600						•						
		RS 100/M t.c.	3789700							•	•				
		RS 130/M t.c.	3789800									•			
		RS 190/M t.c.	3787620										•		
		Gulliver BS 3/M	3762300 (*)	•											3002724
		RS 25/M BLU	3910500 (*)		•	•									
		RS 35/M BLU	3910600 (*)				•								
		RS 45/M BLU	3897304 (*)				•								
		RS 68/M BLU	3897404 (*)					•	•					4031196	
		RS 120/M BLU	3897604 (*)							•	•				
		RS 160/M BLU	3788008 (*)									•	•		
		RS 25/E BLU	3910700 (*)		•	•									
		RS 35/E BLU	3910800 (*)				•								
		RS 45/E BLU	3897330 (*)				•								
		RS 68/E BLU	3897430 (*)					•	•						
		RS 120/E BLU	3897630 (*)							•	•			4031187	
		RS 160/E BLU	3788030 (*)									•	•		

(*) Low Nox: low nitrogen oxide emissions.

NOTE: Burners must be fitted with a gas ramp device.

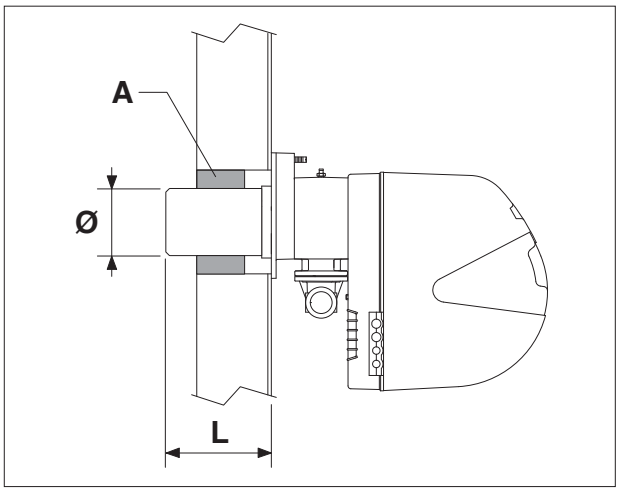
⚠ See the instruction manual provided with the burner for further information on:
- burner installation
- electrical connections
- eurner adjustments.

IMPORTANT!
If you are installing a new boiler but re-using an old burner, always perform the following checks.

- Make sure that the performance of the old burner is adequate for the requirements of the boiler.

- Make sure that the length and diameter of the burner nozzle are as specified in the following table.

⚠ When you finish installing the burner in the boiler, fill the gap between the burner nozzle and the refractory material in the door with the ceramic insulation (A) supplied with the boiler.



MODEL	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N
Min. L (mm)	160	216	216	216	216	250	250	250	280	350
Ø (mm)	130	140	140	140	152	179	179	179	189	222

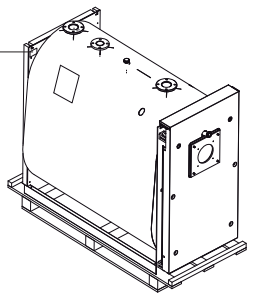
⛔ Do not re-use old burners if their nozzle lengths are below those specified in the table.

PRODUCT IDENTIFICATION

TAU boilers are identified by two plates:

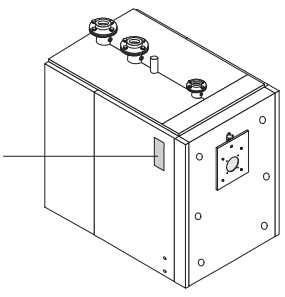
- Serial number plate

This is located on the boiler body and specifies the serial number, model, and furnace power.



- Data plate

This lists the appliance's technical specifications and performance.
It comes inside the documentation envelope. On completion of the installation you MUST APPLY IT in a clearly visible position at the top of one of the side panels.
If you damage or lose this label, order a replacement immediately from **RIELLO**'s Technical Assistance Service.



⚠ If these plates or any other means of clearly identifying the product are defaced, removed or lost, proper installation and servicing may be rendered difficult.

ACCESSORIES

The following accessories are available, to be ordered separately:

ACCESSORY	CODE
Burner plate for steel boilers	4031187
Burner plate	4031196
N2 neutralisation kit (TAU 150-350)	4031810
HN2 neutralisation kit (TAU 150-350)	4031811
N3 neutralisation kit (TAU 450-1250)	4031812
HN3 neutralisation kit (TAU 450-1250)	4031813

TECHNICAL SPECIFICATIONS

Description	BOILER model										
	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N	
Fuel	GAS										
Rated heat input (Q max)	150,0	210,0	270,0	349,0	450,0	600,0	800,0	1000,0	1250,0	1450,0	kW
Rated heat input (Q min)	111,0	151,0	211,0	271,0	350,0	451,0	601,0	801,0	1001,0	1251	kW
Rated maximum useful heat output (80/60°C) (Pn max)	147,8	207,3	269,9	346,7	445,2	593,6	791,2	989,4	1236,7	1434,6	kW
Rated minimum useful heat output (80/60°C) (Pn min)	108,2	147,2	205,7	265,6	339,5	437,5	583,0	777,0	971,0	1213,5	kW
Rated maximum useful heat output (40/30°C) (Pn max)	159,7	223,6	290,2	375,2	481,5	642,0	802,5	1070,0	1337,5	1551,5	kW
Useful efficiency at Pn max (80/60°C)	98,5	98,7	99,9	99,3	98,9	98,9	98,9	98,9	98,9	98,9	%
Useful efficiency at Pn min (80/60°C)	97,5	97,5	97,5	98,0	97,0	97,0	97,0	97,0	97,0	97,0	%
Useful efficiency at Pn max (50/30°C)	106,5	106,5	106,5	106,5	106,5	106,5	106,5	106,5	106,5	106,5	%
Useful efficiency at Pn max (40/30°C)	106,5	106,5	107,5	107,5	107,0	107,0	107,0	107,0	107,0	107,0	%
Useful efficiency at 30% of Pn (30°C)	106,6	106,8	109,0	107,3	107,0	107,0	107,0	107,0	107,0	107,0	%
Losses from stack for sensible heat (Qmax)	1,7	1,7	1,5	1,5	1,9	1,9	1,9	1,9	1,9	1,9	%
Losses from casing with burner on	0,3	0,3	0,5	1,0	0,6	0,6	0,6	0,6	0,6	0,6	%
Constant pressure drop	<1										%
Flue gas temperature (ΔT)	< 45÷75 (*)										°C
Flue gas mass flow rate (Q max) (**)	0,07	0,09	0,12	0,15	0,20	0,26	0,33	0,43	0,54	0,63	kg/sec
Furnace pressure	2,0	2,7	3,2	4,6	5,0	5,5	5,7	6,3	6,8	7,4	mbar
Furnace volume	172,0	172,0	241,0	279,0	442,0	496,0	753,0	845,0	1037,0	1249,0	dm^3
Total volume of flue gas side	253,0	277,0	413,0	482,0	737,0	860,0	1290,0	1454,0	1763,0	2097,0	dm^3
Heat exchanger surface area	6,1	8,8	13,0	16,3	21,8	28,8	39,6	46,5	56,2	62,28	m^2
Volumetric heat load (Q max)	872,1	1220,9	1120,3	1250,9	1018,1	1209,7	996,0	1183,4	1205,4	1160,9	kW/m^3
Specific heat load	23,75	23,10	20,4	20,9	20,1	20,3	18,5	21,0	21,7	22,6	kW/m^2
Maximum condensate production	18,4	27,4	31,9	40,9	52,2	73,8	88,0	111,4	132,7	159,5	l/h
Maximum working pressure	6										bar
Maximum admissible temperature	100,0										°C
Maximum working temperature	80,0										°C
Pressure drop ΔT 10°C	150,1	100,4	121,5	128,7	30,2	33,8	46,4	54,0	36,0	43,2	mbar
Pressure drop ΔT 20°C	36,3	28,4	30,6	28,7	8,5	9,0	13,4	16,3	10,2	11,3	mbar
Water capacity	323	360	495	555	743	770	1320	1395	1825	1900	l
Turbulators	22	39	52	59	72	90	106	114	130	145	n°

(*) Depends on return temperature (30-60°C)

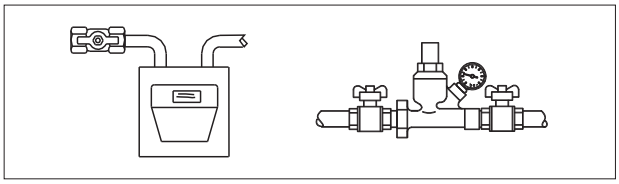
(**) At Pn max and output T = 80°C, return T = 60°C and CO_2 = 9.7%

⚠ The stack must guarantee the minimum draught specified by applicable technical standards, assuming zero pressure at the connection to the flue.

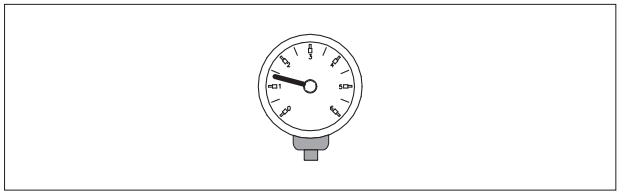
⚠ Values obtained with **RIELLO** burners: BS - RS - RS.../M - RS.../M BLU.

Have **RIELLO**'s Technical Assistance Service start-up your **RIELLO** TAU boiler for the first time. Once this has been done, the boiler can be left to function automatically.
Under certain circumstances, such as after long periods of disuse, the service engineer responsible for the boiler may need to re-start it without involving the Technical Assistance Service.
To do so, perform the following checks and operations:

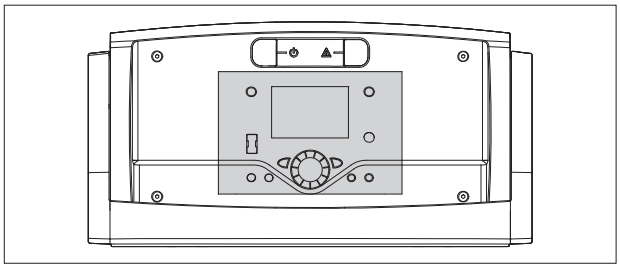
- Check that the gas cock and heating water cock are shut.



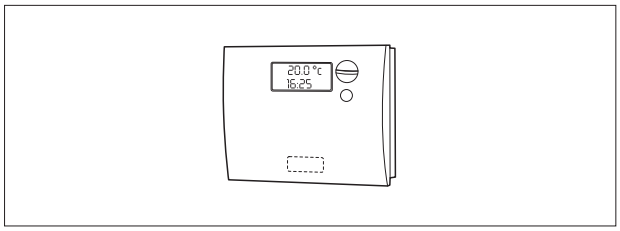
- While the system is still cold, check that working pressure in the heating circuit is **over 1 bar** but below the maximum limit specified for the appliance.



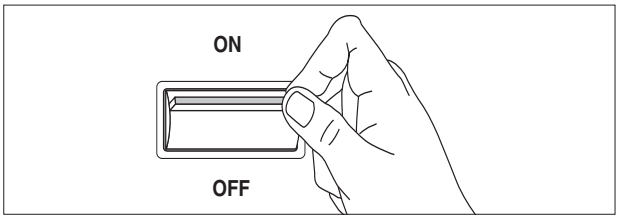
- Since the control panel incorporates a temperature control function, make sure that the control panel is switched on.



- Adjust the timer thermostat (if installed) or the temperature control to the desired temperature (~20° C).

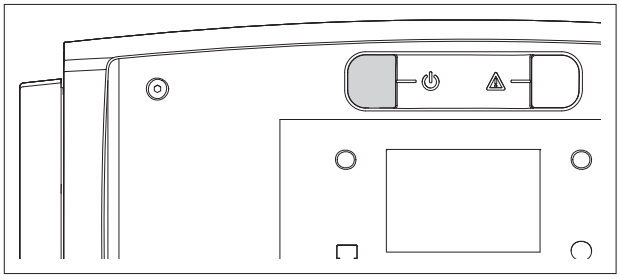


- Turn the system's main power switch ON.



- Turn the control panel power switch ON and make sure that the green power indicator lights.

- Make the settings as instructed in the instruction manual for your control panel.



The burner should now ignite and remain in operation until the set temperature is reached.
The burner will then switch off and on automatically to maintain the set temperature without further operator action.
If any ignition faults or malfunctions occur, the burner performs a “LOCKOUT SHUTDOWN”. This is shown by the red button light on the burner and by the warning light on the control panel.

⚠ If a “LOCKOUT SHUTDOWN” occurs, wait about 30 seconds before resetting the burner.

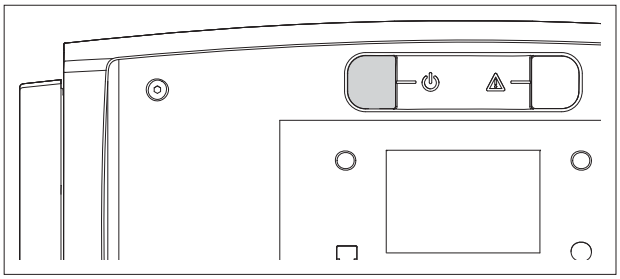
To reset the burner, press the red button light on the burner and wait until the flame ignites.

Repeat this operation 2 -3 times at the most. If the problem persists after that, call **RIELLO**’s Technical Assistance Service.

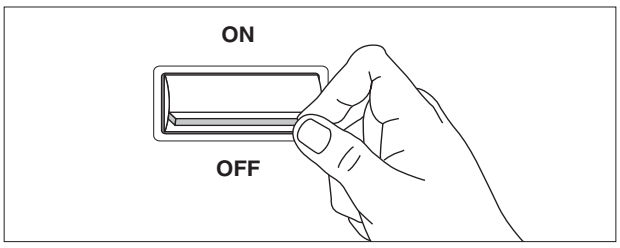
PREPARING FOR EXTENDED PERIODS OF DISUSE

If the boiler is not going to be used for an extended period of time, perform the following operations:

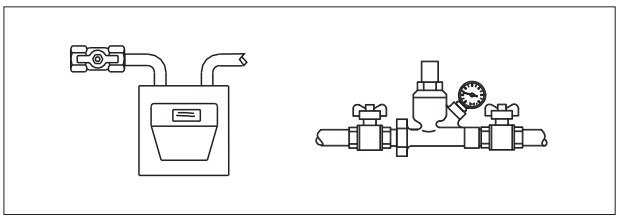
- Turn the control panel power switch OFF and make sure that the green power indicator goes out.



- Turn the system’s main power switch OFF.



- Close the fuel cock and heating water cock.



- Drain the central heating circuit if there is any risk of freezing.

⚠ Contact **RIELLO**’s Technical Assistance Service if you encounter any problems in completing the above procedure.

CLEANING

Use a cloth damped in soapy water to clean the boiler's external panelling.
To remove stubborn marks, use a cloth damped in a 50% mix of water and denatured alcohol or a suitable cleaning product.
Carefully dry the boiler after cleaning.

⛔ Do not use abrasive cleaning pads or powder detergents.

⛔ Never clean the boiler without first disconnecting it from the mains electricity supply by turning the main power switch and the control panel switch OFF.

⚠ The combustion chamber and flues must be cleaned periodically by **RIELLO**'s Technical Assistance Service or by a qualified technician (see page 35).

MAINTENANCE

THE PERSON RESPONSIBLE FOR SYSTEM OPERATION MUST ENSURE THAT PROFESSIONALLY QUALIFIED PERSONNEL UNDERTAKE PERIODIC MAINTENANCE AND COMBUSTION EFFICIENCY MEASUREMENTS. (In Italy this is stipulated by Presidential Decree 412 of the 26th August 1993.)

RIELLO's Technical Assistance Service is qualified to satisfy these legal requirements and can also provide useful information on MAINTENANCE PROGRAMMES designed to guarantee:
- greater safety;
- compliance with applicable legislation;
- freedom from the risk of fines in the event of spot checks.

Seller: .....
Mr. .....
Address .....
Tel. .....

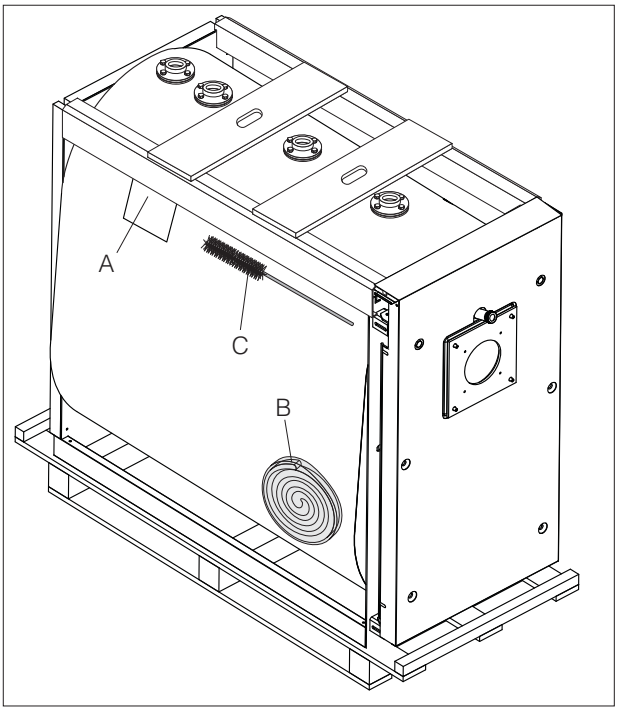
Installer: .....
Mr. .....
Address .....
Tel. .....

Technical Assistance Service: .....
Mr. .....
Address .....
Tel. .....

Date	Work done

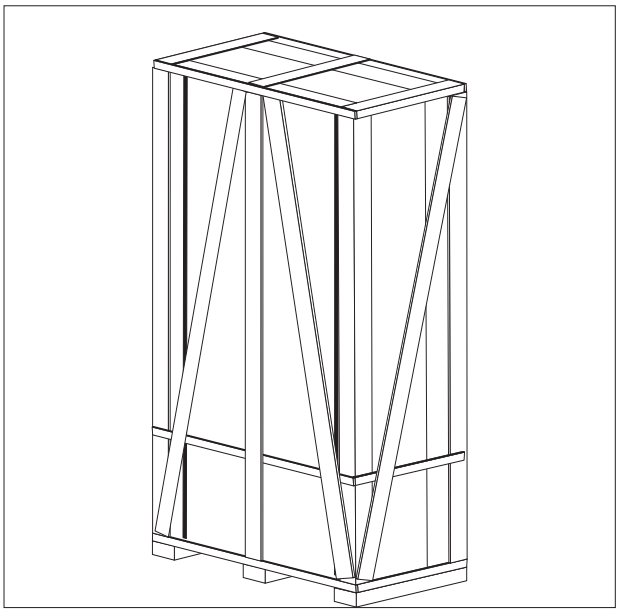
RIELLO TAU steel boilers come in **2 separate crates**:

1) **BOILER BODY CRATE,** bearing the documentation envelope (A) and containing:
   - Instruction manual;
   - Data label (to be applied to the panelling on completion of the installation);
   - Certificate of Warranty and water test certificate;
   - Bar code labels.
   - Spare parts catalogue
   - Ceramic insulation (B)
   - Cleaning brush (C).



⚠ The instruction manual is an integral part of the boiler. Once located, read it thoroughly and keep it safe.

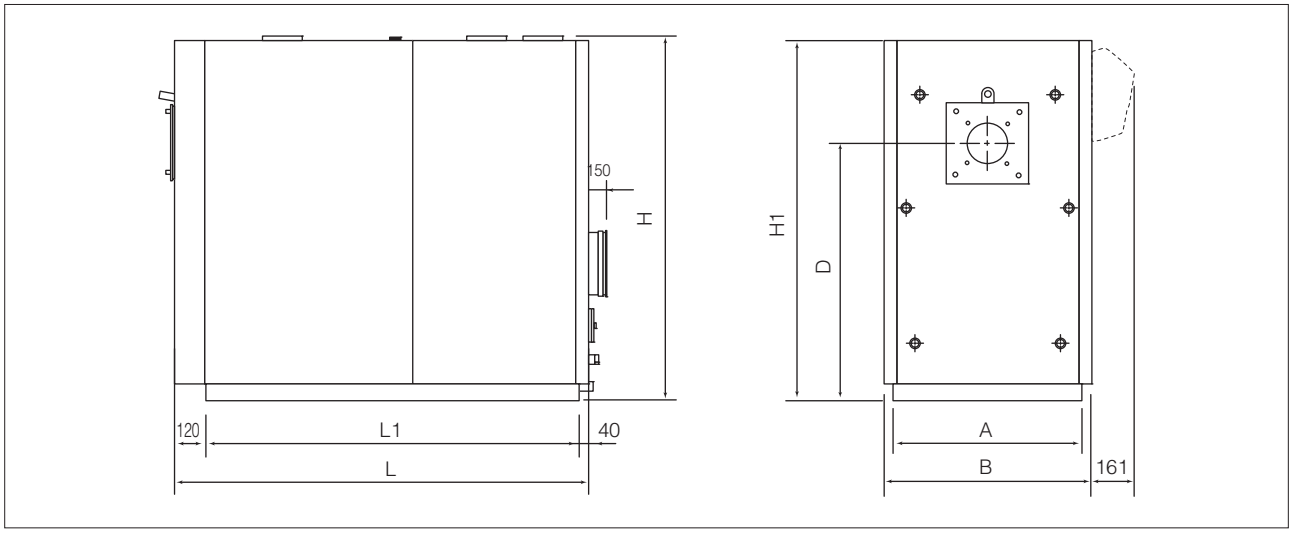
2) **PANELLING CRATE,** complete with assembly accessories, protected by cardboard packaging and a wooden crate.



IMPORTANT!

For the boiler to function correctly, it must be connected to a **RIELLO** control panel and dedicated control accessories.

OVERALL DIMENSIONS AND WEIGHTS



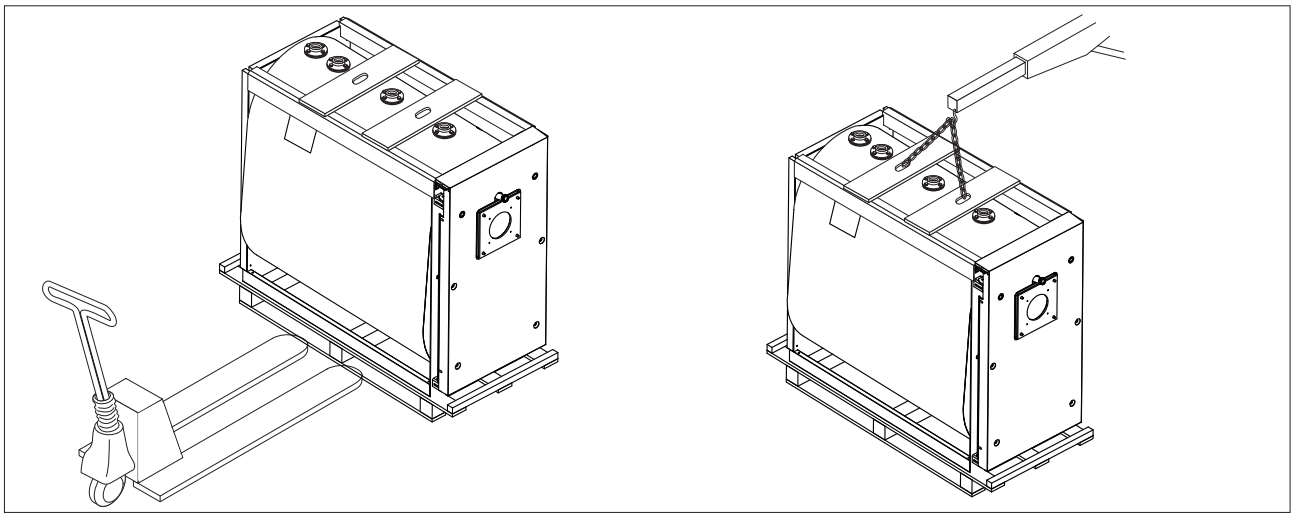
DESCRIPTION	BOILER model										
	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N	
A - Base width	640	640	750	750	790	790	950	950	1070	1130	mm
B - Overall width	740	740	850	850	900	900	1060	1060	1180	1225	mm
L - Depth	1455	1455	1630	1830	2035	2235	2560	2810	3010	3080	mm
L1 - Base depth	1295	1295	1470	1670	1875	2075	2400	2650	2850	2850	mm
H - Height of water fittings	1315	1315	1450	1450	1630	1630	1910	1910	2030	2180	mm
H1 - Boiler height	1300	1300	1437	1437	1615	1615	1900	1900	2015	2167	mm
D - Height of burner plate	925	925	1030	1030	1235	1235	1390	1390	1495	1590	mm
Weight of boiler	510	530	677	753	1095	1250	1870	2085	2515	3050	Kg
Weight of panelling	50	50	60	70	90	120	140	160	215	230	Kg

HANDLING

RIELLO TAU steel boilers are fitted with lifting attachments. Take great care when moving them and only use lifting equipment of adequate capacity.

Remove the transport straps and remove the wooden pallet before positioning the boiler.

⚠ Wear suitable personal protective equipment and use suitable safety devices.



RIELLO TAU steel boilers must be installed in a dedicated boiler room, with adequately sized vents, in compliance with applicable laws and standards.
If at all possible, the boiler should be installed on a raised base to stop the burner fan sucking up dust and to facilitate installation of a condensate drain system.

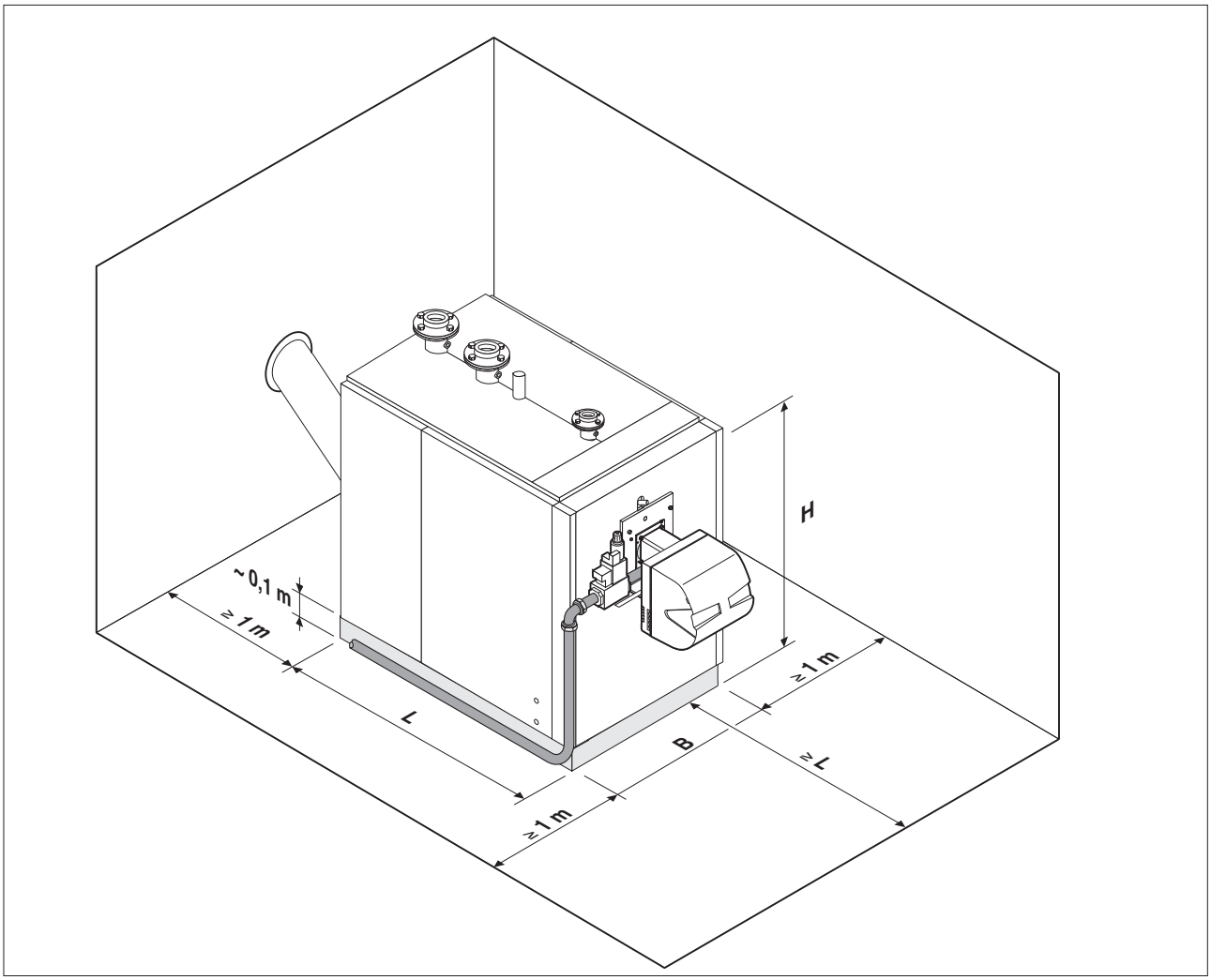
The boiler condensate drain must be located above the height of the lid of the system's condensate neutraliser.

The gas supply pipe must be installed in such away that the boiler's panelling can be removed and the front door opened without having to remove the burner.

⚠ When installing the boiler, allow sufficient space around it to access all safety and control devices and to permit easy maintenance.

⚠ If the specific weight of the gas supply to the burner is greater than the specific weight of air, install all electrical parts at least 500 mm above floor level.

⛔ Do not install the boiler outdoors. It is not designed to work outdoors and is not fitted with the necessary automatic anti-frost systems to do so.



DESCRIPTION	BOILER model										
	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N	
B - Width	750	750	850	850	900	900	1000	1000	1200	1250	mm
L - Depth	1350	1350	1620	1820	1930	2140	2400	2700	2920	3100	mm
H - Overall height (boiler + base)	1420	1420	1540	1540	1700	1700	2010	2010	2130	2280	mm

INTRODUCTION

The water used in the central heating system MUST be suitably treated to ensure the correct functioning of the system and to guarantee an extended working life for the boiler and all other system components.
Sludge, limescale and other contaminants in the water supply can cause irreversible damage to the boiler even in relatively short times, and despite the use of top quality materials in its manufacture.
It is common practice for water treatment to be applied only to old systems and systems already affected by limescale, deposits and sludge. In stark contrast with this practice, proper water treatment is actually essential to extend component life and to ensure the continued efficiency of new installations too.
For further technical information on water treatment, refer to the following section which contains a study published by ANICA (the Italian National Association of Steel Boiler Manufacturers), and to the appendix to this manual, which contains an extract from UNI standard 8065 governing 'Water Treatment in Domestic Heating Systems'.
Contact **RIELLO**'s Technical Assistance Service for further information on water additives and their use.

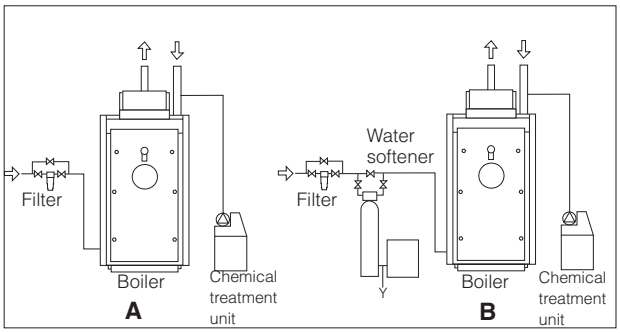
⚠ If it proves impossible to treat the heating system water supply properly because the water charging system is automatic and uncontrolled, if there are no barriers installed to prevent water oxygenation, and if the heating circuit includes an open expansion vessel, then the boiler itself must be separated from the heating system by means of a heat exchanger.

Heating system water: Instructions for the design, installation and management of heating systems

1. Chemical and physical characteristics

Reference standards prescribe certain required values. (In Italy the relevant standard is UNI-CTI 8065 'Water Treatment in Domestic Heating Systems', June 1989 edition.)
In particular, this standard assumes that the chemical and physical composition of heating system water is similar to that of drinking water.
The standard also requires that all systems be fitted with a chemical water treatment device to protect system components as well as an inlet filter to prevent solid particles from entering the system in suspension and causing corrosion or sludge.

Layout showing the water treatment devices required by Italian standard UNI-CTI 8065, according to the system's overall heat output



A
Water treatment for heating installations:
- with heat output < 350 kW and water supply hardness < 35° fr
- with heat output > 350 kW and water supply hardness < 15° fr
- a filter is recommended for systems with heat output < 350 kW
- a filter is obligatory for systems with heat output > 350 kW

B
Water treatment for heating installations:
- with heat output < 350 kW and water supply hardness > 35° fr
- with heat output > 350 kW and water supply hardness > 15° fr
- a filter is recommended for systems with heat output < 350 kW
- a filter is obligatory for systems with heat output > 350 kW

Chemical and physical water parameters required by Italian standard UNI-CT 8065

Parameters	Unit of measure	System filling water	Circuit water
pH*		-	7÷8
Total hardness ($CaCO_3$)	°fr	<15	-
Iron (Fe)**	mg/kg	-	<0,5
Copper (Cu)**	mg/kg	-	<0,1
Appearance		Clear	Clear if possible

*The maximum limit of pH 8 refers to systems with radiators made from aluminium or light alloy elements.
**Higher pH values are indicative of corrosion.

Identification of water treatments required by Italian standard UNI CTI 8065

A resin ion exchange type water softener is required. The filter may be either washable or disposable.
The most suitable form of water treatment consists of the addition of specific chemical products (water conditioners) to:

- Stabilise hardness
- Disperse unwanted organic and inorganic deposits
- De-oxygenate the water and passivate component surfaces
- Correct the pH
- Form a protective film over component surfaces
- Control biological growth
- Provide anti-freeze protection

⚠ Chemical products used for water treatment must be compatible with applicable water pollution laws. Provided it is properly applied, Italian standard UNI-CTI 8065 guarantees the safe functioning of a heating system. The desired effects of the standard may nevertheless be cancelled out by incorrect installation or system management practices, including excessive topping up and the circulation of water through open expansion vessels.
The standard is often not properly respected. In particular, in existing systems, insufficient attention is paid to the characteristics of the water supply and to the need to adopt corrective measures.

2. Central heating systems

Possible causes for corrosion and limescale

Until some forty years ago, central heating was not in common use in the home, and heating was provided instead by systems that today are considered extremely old-fashioned. The problem of water characteristics was not therefore of any real importance.
Then the energy crisis, the widespread appearance of central heating and the introduction of standards governing it stimulated boiler and heating system manufacturers to develop more sophisticated materials and more advanced (though often more delicate) high efficiency heating solutions. Unfortunately because they failed to appreciate the importance of water treatment, the excellent efficiency levels initially achieved were rapidly lost to limescale and corrosion.

Typical problems encountered in central heating systems include:
- the breakage of heated surfaces through overheating caused by the thermal insulation of limescale deposits on the water side
- oxygen corrosion
- deposit corrosion
- stray current corrosion (now rare)
- diffused and localised acid corrosion (caused by the aggressive nature of water with a pH < 7)

2.1 Limescale deposits
Limescale forms when the calcium and magnesium bicarbonates that are dissolved in the water at ambient temperature become chemically transformed when the water is heated.
Calcium bicarbonate forms calcium carbonate, water and carbon dioxide, while magnesium bicarbonate transforms into magnesium hydroxide and carbon dioxide.

Calcium bicarbonate $Ca(HCO_3)_2$
----increased temperature---->
$CaCO_3 + H_2O + CO_2$

Magnesium bicarbonate $Mg(HCO_3)_2$
----increased temperature---->
$Mg(OH)_2 + 2CO_2$

Calcium carbonate and magnesium hydroxide precipitate to form insoluble deposits that adhere and compact on surfaces to form limescale, a substance with an extremely high thermal insulating power. The coefficient of heat exchange of a 3 mm layer of limescale is the same as that of a steel sheet 250 mm thick! It has been calculated that 2 mm of limescale throughout a system causes an increase in consumption of 25%! The reactions that cause limescale to form accelerate as temperature increases. Generally speaking, if water comes from an area rich in calcium and magnesium deposits, it will be 'hard' water and perfectly capable of forming limescale at any temperature above 40°C. Inside a boiler, limescale forms mainly in areas subject to direct heat and high temperatures. That is why it is so common to find deposits localised in a few specific areas, where temperature is the highest.
A coating of limescale of only 1 mm can effectively reduce the cooling of the surface it covers.
If that coating continues to increase, it can cause severe overheating in metal parts and consequent breakage through thermal stress. The water used to fill a heating system for the first time never contains enough calcium and magnesium bicarbonates to endanger the boiler. It is continuous topping up that causes thick deposits to form, leading to boiler breakdown.

2.2 Oxygen corrosion
Oxygen corrosion is the result of a natural phenomenon, the oxidation of steel. In nature, iron does not occur in its pure state, but always in combination with other elements and nearly always with oxygen (as ferrous or ferric oxide). Iron can only be separated from its oxygen bond in a blast furnace capable of smelting the ore.
Once solidified in the form of steel (and therefore combined with other elements), iron inevitably tends to re-absorb oxygen from the surrounding air or water in order to re-establish its original equilibrium. This is the explanation behind the normal process of oxidation.
The steel sheets and tubes inside a boiler or heating system absorb oxygen not from the water (H_2O), but from micro-bubbles of air naturally dissipated in it.

Remember that air dissolved in water has an oxygen content of around 35%, far higher than air in its natural gaseous state.
It is therefore particularly easy for steel that comes into contact with water in heating systems to absorb oxygen from the micro-bubbles contained in it to form the characteristically red coloured ferric oxide Fe_2O_3 (rust).
$4Fe + 3O_2 = 2Fe_2O_3$ (ferric oxide, or rust)
If not prevented, oxidation inevitably leads to a reduction on the original thickness of the metal, and eventually to its complete penetration.
Corrosion is easily recognisable from the formation of small round pock-marks (like tiny craters) in the surface of the metal. If corrosion ever penetrates all the way through a boiler part, massive leakage is inevitable.
Oxygen corrosion affects metal throughout the heating system and not just at determined points. It is therefore a particularly destructive form of corrosion. Furthermore, because it cannot be repaired, it can easily cause permanent leakage from the circuit.
If, on the other hand, the system is well protected from the outside world and top-ups of fresh water are not continuously added, the oxygen content in the circuit gradually diminishes. The little oxidation that does occur occurs in a reduced oxygen environment, and forms black magnetite (Fe_3O_4) which actually protects steel surfaces against further attack.
$3Fe + 2O_2 = Fe_3O_4$ (triiron tetraoxide, or magnetite)

2.3 Deposit corrosion
Deposit corrosion is an electro-chemical phenomenon caused by the presence of foreign bodies (sand, rust, etc.) in the water mass. These solid substances generally form deposits (sludge) in the bottom of the boiler.
The lower parts of the boiler can therefore be affected by a chemical reaction of micro-corrosion caused by the electrochemical potential difference created between the metal (steel) and the impurities around it.

2.4 Stray current corrosion
Stray current corrosion is actually very rare today, but can be caused by the different electrical potentials of the boiler water and the metal body of the boiler or piping creating a cathode/anode effect.
All metal part of the boiler should therefore be connected to an efficient ground (earth) point, even though this form of corrosion is actually caused by the passage of DC current, no longer used for domestic power. Stay current corrosion is easily identified by the regular tiny conical holes it leaves.

2.5 Diffused and localised acid corrosion
Other forms of corrosion exist that are harder to see but nonetheless dangerous because they affect the entire heating system and not just the boiler.
These forms of corrosion are generally due to the water becoming acidic (pH < 7), and are caused by:
- Incorrect water softening and the presence of carbon dioxide (which lowers the water's pH). Carbon dioxide is released more easily in softened water and also forms during the limescale formation process. Acid corrosion is diffuse and attacks the entire circuit more or less uniformly.
- Incorrect acid washing (e.g. washing done without a passivating agent). Acid introduced into the circuit can cause localised perforation if it is not properly removed from all parts of the system. The formation of corrosion can easily be detected by analysing the chemical composition of the water. Even a minimal iron content is a clear sign that corrosion is occurring.

⚠ The technical details provided in this section refer specifically to domestic and industrial hot water heating systems with working temperatures up to 100 °C.
Users of this type of heating system (unlike users of steam and super-heated water systems) frequently underestimate the potential problems caused by failure to perform proper water treatment and by system design and operating errors.
Unfortunately, failure to cater for the risks involved often leads to serious damage to the boiler and to the entire circuit.
In Italy, Article 7 of Law 46/90 governing the treatment of potable water, states that central heating systems and domestic hot water production systems must be constructed according to Italian UNI and CEI standards (UNI 8065). Depending on the conditions of the water supply, suitable treatment systems must be built in from the design stage to ensure that the water used meets the relevant requirements.
The system operator must likewise maintain the system within the specified operating limits, using all necessary checks and actions to do so.

3. New central heating systems
Mistakes to avoid and precautions

From what has been said above we can see that it is essential to avoid two main factors that could lead to corrosion. These are contact between the water in the system and the air and the continuous addition of fresh water to the circuit.
To eliminate contact between system water and the air (thus avoiding oxygenation of the system water), we need to:

- ensure that the expansion vessel is a closed vessel, and of the correct size and pre-charge pressure (the pressure to be checked periodically);
- ensure that the system is always kept at a pressure higher than atmospheric pressure at all points (including the pump suction side) and at all operating conditions (precisely because the seals, gaskets and joints in a water circuit are designed to resist pressure from within, but not to resist a vacuum within);
- ensure that no part of the system is made from materials that are permeable to gases (e.g. plastic pipes with no oxygen barrier used in floor heating systems).

⚠ The original system filling water and any topping up water must always be filtered (using synthetic or metal mesh filters with a filtration rating of no less than 50 microns) to prevent sludge from forming and triggering deposit induced corrosion.

⚠ Loss of water from the system, and the consequent need to add water, can be caused not only by leaks from the circuit, but also from the incorrect sizing of the expansion vessel and by an incorrect initial precharge pressure. (If normal thermal expansion causes pressure in the system to increase beyond the setting of the safety valve, that safety valve will keep opening continuously.)

In theory, once filled and bled of all air, a heating circuit should not need any further topping up.
If it does, one of the problems listed above is inevitably occurring. Any top-ups need to be monitored (by a counter), treated and recorded in the heating system's technical log. It is simply not enough to rely on the reassuring presence of a water softener in conjunction with an automatic filling system.
The continuous addition to a system of water softened to 15°fr will quickly cause deposits/limescale to form on the boiler parts, especially at the hottest points.
Systems should also be heated up slowly the first time they are switched on, then taken to maximum working temperature to facilitate de-aeration (since gas will not be released from the water at low temperatures).
If more than one boiler is installed in a large system, all boilers must be switched on at the same time to ensure that the initial small precipitation of limescale is uniformly distributed.

4. Reconditioning old heating systems
Frequent mistakes and necessary precautions

Frequently, when old central heating systems are reconditioned, especially when old boilers are replaced, it is impossible to make any modifications to the existing circuit. Nevertheless, failure to pay any attention to the problems involved can cause rapid damage to the new boiler.
Over years of functioning, a protective black coating may well have built up inside an old circuit. This coating (formed mainly from magnetite, Fe3O4, which forms when iron oxidises in an oxygen starved environment) actually offers effective protection against further corrosion.
If new parts with clean metal surfaces, especially boilers, are fitted in an old system, they inevitably become the sacrificial anode for the entire heating circuit. If leaks from a system cannot be repaired and topping up is therefore inevitable, great care must be taken in finding a solution to the problem, and particularly in choosing the water treatment system to use. Water treatment systems should be similar to those used in steam heating systems to fully decalcify the incoming water (hardness <0.5°fr) while maintaining a non-aggressive pH.
Film-forming de-oxidising agents will also have to be dosed in, and a physical filtration system fitted to prevent any impurities entering the circuit.
The reconditioned system must then be started up as instructed above.

The following notes deal with a number of important issues, and can be of help in reconditioning old systems and in guaranteeing the correct functioning of new boilers over time.

- If an old heating system has an open expansion vessel, this should be converted to a closed vessel if at all possible. Today, this conversion can be performed without unduly affecting the working pressure in the system. This modification solves many of the problems caused by contact between system water and the air (corrosion etc.) and avoids having to condition the water with de-oxidising products, which would otherwise have to be added at regular intervals in an open vessel system.
- f an old system has a very large circuit or is a radiant panel system with plastic pipes with no oxygen barrier, the boiler water circuit should be separated from the heating circuit water by installing a heat exchanger made from corrosion resistant material. This enables the new boiler to remain protected even in old systems that cannot be modernised.

5. Eliminating air and gas from central heating systems.

Another problem that is frequently ignored, even when designing new heating systems, is the need to eliminate the air and other gases that form in the circuit.
Many designers seem to think that after a system has been filled and bled for the first time, further bleeding will not be necessary.
Systems are therefore often made without suitable bleed points, of with incorrectly located vent valves.
The automatic vent valves that are installed are often too small. These become blocked as soon as the system is filled, simply because the union between the valve and the pipe is too small, and only big enough to let the tiniest of bubbles through. Remember that air and gas in the water circuit not only cause the corrosion problems listed above, but also reduce thermal efficiency, cause pump malfunctioning and noise and vibration throughout the circuit.
Bubbles of air and gas inevitably form in heating circuits during normal functioning, especially if the precautions listed above are not fully respected. In particular:

- as temperature increases, oxygen becomes less water-soluble and bubbles therefore begin to form;
- CO_2 (carbon dioxide) is generated as the carbonates of calcium and magnesium precipitate out;
- the chemical oxidation of the metals in the system also generates hydrogen.

These gases have to be eliminated as they are formed, and this means that the system needs to be designed and installed so that all gases can be vented quickly, easily, and effectively.
One solution is to install a gas collection tank at the highest point of the circuit, with a suitably sized manual bleed valve.
Automatic vent valves cannot be used in these applications because the tank would simply fill with water and not function properly.

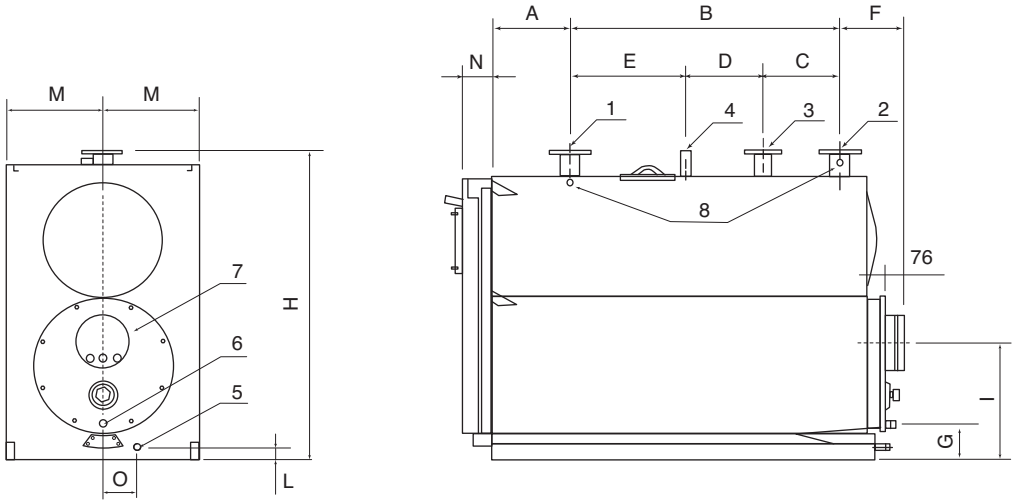
Conclusions
Experience confirms that underestimating the problems described above can have serious consequences, including damage to the boiler and other parts of the heating system.
If this happens, blame is often shifted on to the boiler itself. It is accused of 'producing too much air', or 'furring up because of poor circulation', or 'corroding because of poor quality materials' etc.. Since boilers nowadays are made to excellent quality standards, however, the real causes are to be sought elsewhere.
Never forget that proper water conditioning and proper heating system design not only guarantee safety and security but also ensure significant savings in maintenance costs and overall thermal efficiency.

Finally, never forget that boiler failures caused by encrustation and corrosion are not covered under the terms of the warranty.

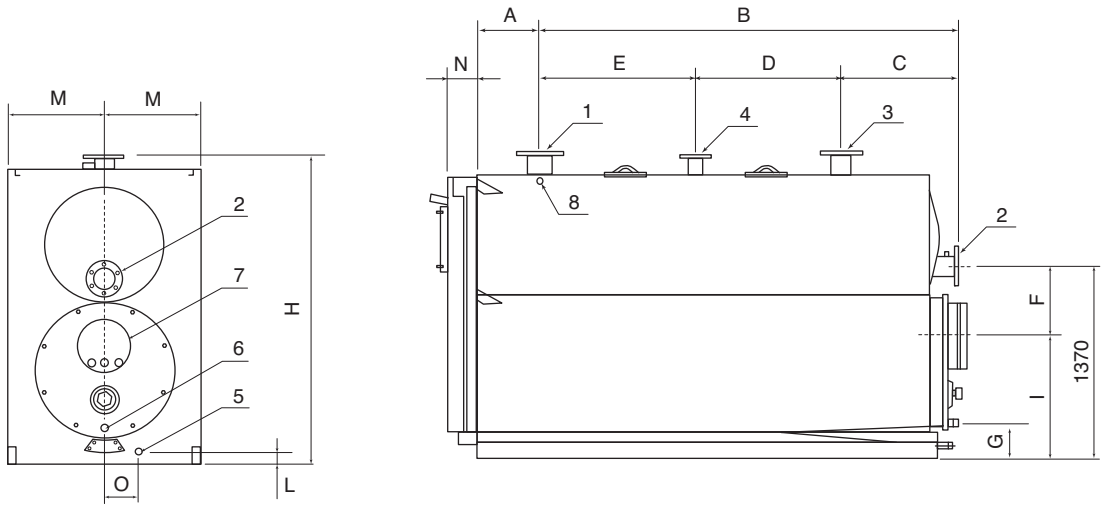
WATER CONNECTIONS

RIELLO TAU boilers are designed and made for use in central heating installations, but can also be used for domestic hot water production if connected to suitable sub-systems. Water fittings are as specified in the following table:

TAU 150÷1250 N and TAU 150÷600 NC models



Mod. TAU 1450 N

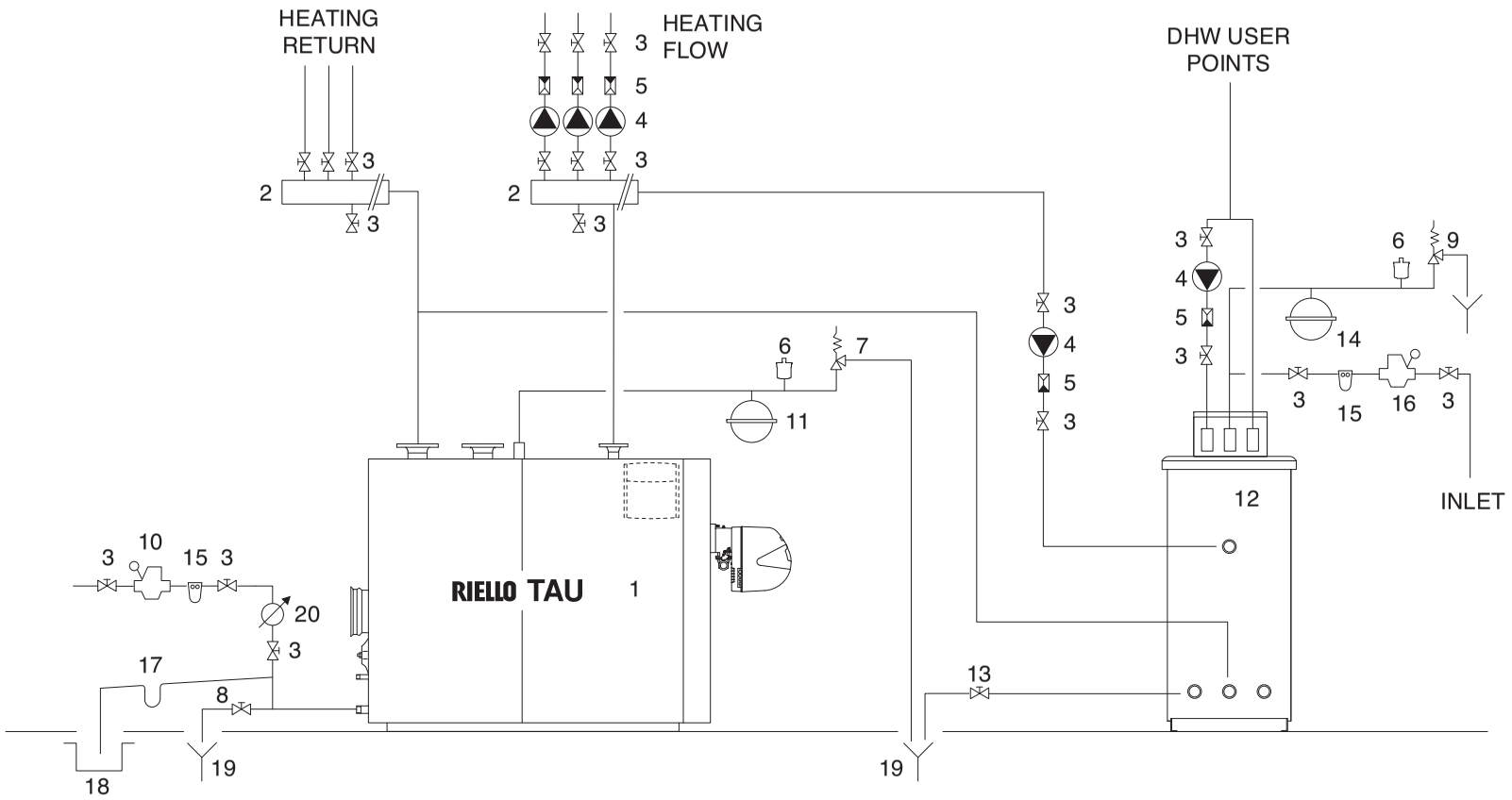


⚠ The choice of system components and the method of their installation are left up to the installer. Installers must use their expertise to ensure proper installation and functioning in compliance with all applicable legislation.

⚠ Circuits filled with anti-freeze must be fitted with water disconnectors.

Description	BOILER model										
	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N	
1 - Heating flow	65	65	65	80	100	100	125	125	150	150	DN
2 - Heating return 1 (Low Temperature)	65	65	65	80	100	100	125	125	150	150	DN
3 - Heating return 2 (High Temperature)	50	50	50	65	80	80	80	80	100	100	DN
4 - Safety device fitting	1" 1/4	1" 1/4	1" 1/4	1" 1/4	1" 1/2	1" 1/2	65	80	80	80	Ø "- DN
5 - Boiler drain fitting	1"	1"	1"	1"	1"	1"	1"1/4	1"1/4	1"1/4	1"1/4	Ø"
6 - Condensate drain fitting	1"	1"	1"	1"	1" 1/4	1" 1/4	1" 1/4	1" 1/4	1"1/4	1"1/4	Ø "- DN
7 - Flue gas exhaust fitting	200	200	250	250	300	300	350	350	400	450	Ø mm
8 - Instrument bulb/probe sockets	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	3 x 1/2"	n° x Ø "
A - Distance from burner head to heating flow outlet	300	300	300	315	311	311	410	410	430	440	mm
B - Distance from heating flow outlet to return 1	685	685	1050	1235	1400	1600	1800	2050	2200	2585	mm
C - Distance between heating returns 1 & 2	200	200	300	250	250	300	350	350	350	735	mm
D - Distance between heating return 2 and safety device fitting	285	285	300	450	600	700	750	850	850	850	mm
E - Distance between heating flow outlet and safety device fitting	400	400	450	535	550	600	700	855	1000	1000	mm
F - Distance between heating return 1 and flue gas outlet	200	200	225	225	270	270	325	325	345	560	mm
G - Height of condensate drain	160	160	165	165	215	215	195	195	225	235	mm
H - Height of boiler flanges	1315	1315	1450	1450	1630	1630	1910	1910	2030	2180	mm
I - Height of flue gas outlet	505	505	545	545	645	645	680	680	720	805	mm
L - Height of boiler drain fitting	55	55	55	55	75	75	95	95	105	85	mm
M- Boiler centreline	320	320	375	375	395	395	475	475	535	565	mm
N- Distance from burner head to door	110	110	120	120	125	125	125	125	140	150	mm
O - Distance from Boiler drain fitting	110	110	137	137	85	85	175	175	115	180	mm

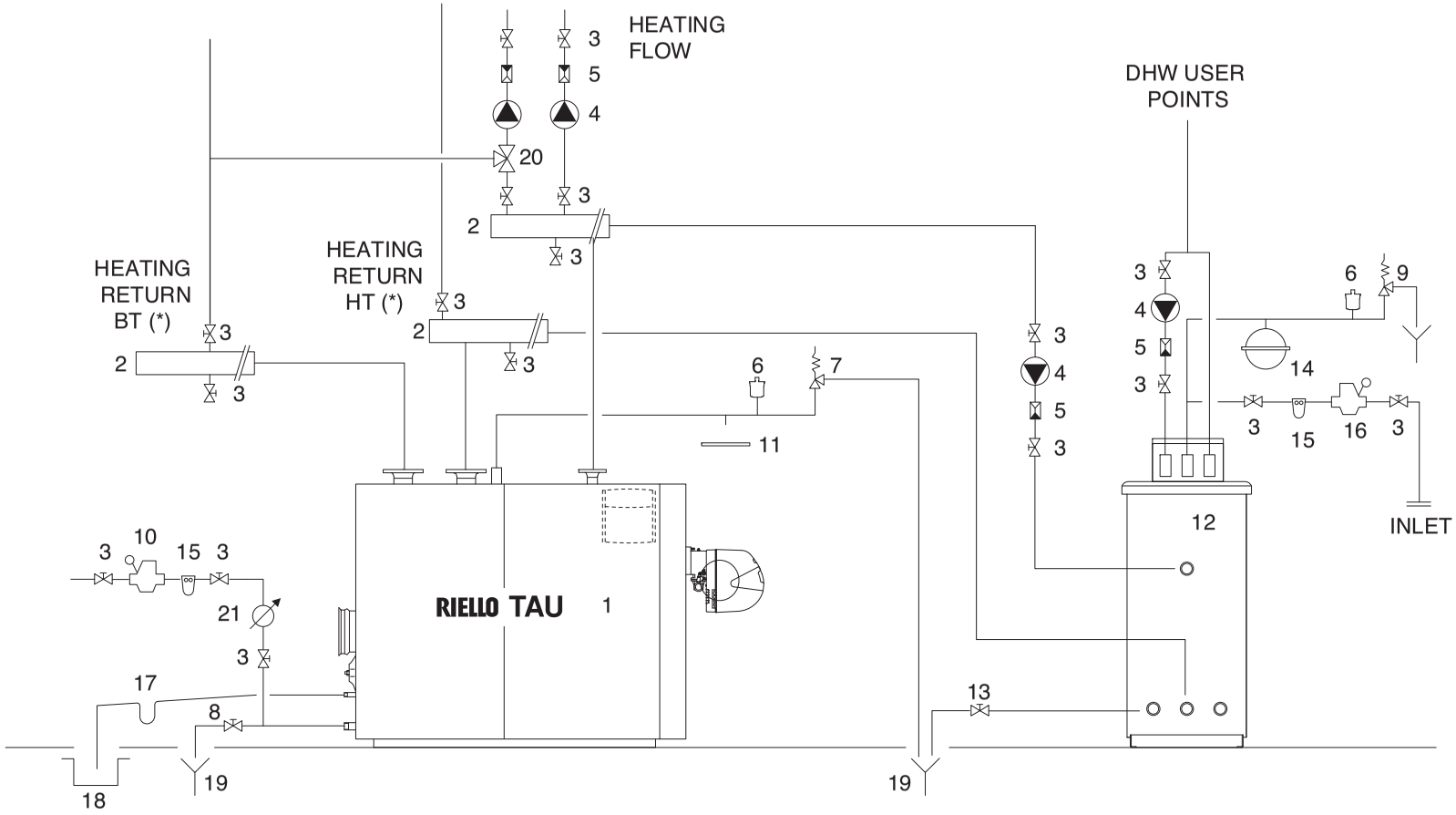
FUNCTIONAL LAYOUT - 1 - DIRECT SYSTEMS



1 - Boiler
2 - Heating system manifolds
3 - Isolating valves
4 - Central heating pumps
5 - Non-return valves
6 - Automatic vent valve
7 - Boiler safety valve
8 - Boiler drain cock
9 - Storage heater safety valve
10 - Heating system filling valve
11 - Heating system expansion vessel
12 - Remote storage cylinder (RIELLO 7200)
13 - Storage cylinder drain cock
14 - DHW circuit expansion vessel
15 - Water softener filter
16 - Pressure reducer
17 - Siphon
18 - Condensate drain
19 - Drain
20 - Water supply/top-up counter

NOTE: If the heating circuit operates at a pressure greater than the working pressure of the boiler, fit a heat exchanger between the boiler and the heating system flow and return manifolds.

FUNCTIONAL LAYOUT - 2 - DIRECT AND MIXED SYSTEMS



1 - Boiler
2 - Heating system manifolds
3 - Isolating valves
4 - Central heating pumps
5 - Non-return valves
6 - Automatic vent valve
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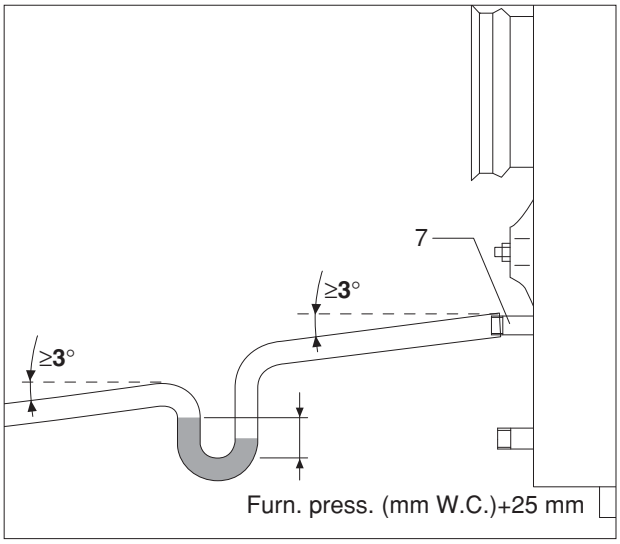
8 - Boiler drain cock
9 - Storage heater safety valve
10 - Heating system filling valve
11 - Heating system expansion vessel
12 - Remote storage cylinder (RIELLO 7200)
13 - Storage cylinder drain cock
14 - DHW circuit expansion vessel
15 - Water softener filter
16 - Pressure reducer
17 - Siphon
18 - Condensate drain
19 - Drain
20 - Servo valve
23 - Water supply/top-up counter
(*) - HT = High Temperature
BT = Low Temperature

DRAINING THE CONDENSATE

TAU condensing boilers produce a flow of condensate that varies according to operating conditions. The maximum hourly production of condensate is shown in the technical specifications table for each individual model. The condensate drain system must be suitably dimensioned to cope with the flow produced. Also, pipe and hose diameter must not be less than 1" at any point. This diameter corresponds to that of the boiler's condensate drain fitting (7).

The connection to the waste water drain pit must be made in compliance with national and local legislation and standards.

To prevent combustion fumes from leaking into the air of the boiler room, the condensate drain pipe must incorporate a siphon creating a minimum head equivalent to the furnace pressure (see the 'Technical Specifications' table on page 9) plus 25 mm. The connecting pipes between the boiler, siphon and waste water drain pit must be laid at a minimum down slope of 3° and must be installed in such a way as to prevent any build-up of condensate.



Es: (TAU 270 N-NC)
- Furnace pressure = 3.2 mbar = 32 mm W.C.
- siphon head = 32 + 25 = 57 mm (approx.)

NEUTRALISING THE CONDENSATE

NEUTRALISATION UNIT TYPE N2-N3

N2-N3 neutralisation units are designed for systems with boiler condensate drain pits located at a lower level than the boiler condensate drain fitting. These neutralisation units do not require any electrical connections.

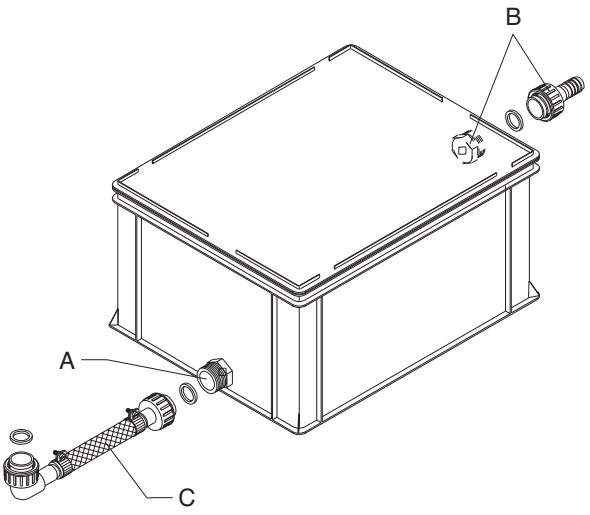
Type	Q.ty of granulate	Dimensions (mm)	Fitting Ø
N2	25Kg	400x300x220	1"
N3	50Kg	600x400x220	1" 1/2

The inlet fitting (A) of the N2 neutralisation unit (the lower fitting) must be connected to the boiler condensate drain fitting using the flexible hose (C) supplied. This condensate drain hose is specially made to prevent combustion fumes escaping into the atmosphere.

The outlet fitting (B) of the neutralisation unit (the top fitting) must be connected to the boiler room's waste water drain pit using another section of flexible hose (not supplied).

⚠ The boiler room's condensate drain pit must be located at a lower level than the fitting (B) on the neutralisation unit.

N2-N3

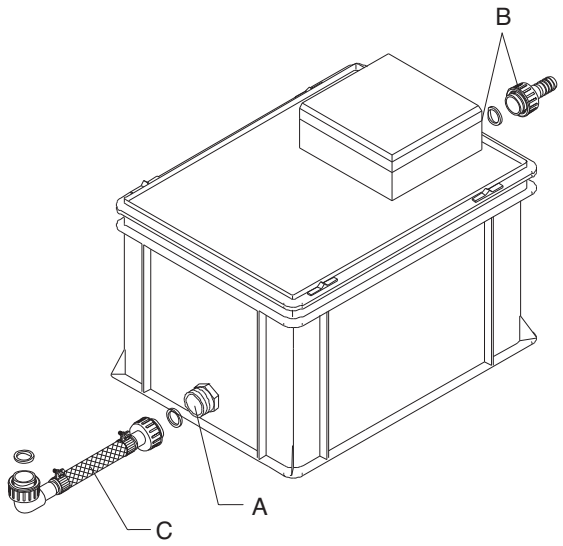


⚠ All connecting hoses must be kept as straight and as short as possible. Any curves or sharp bends can lead to the hoses becoming clogged and can therefore prevent proper condensate discharge.

If it ever proves necessary to neutralise the condensate that forms in the flue gas stack, connect the condensate drain fittings of the boiler and flue gas stack together using a 'T' union and connect the leg of the 'T' to the inlet of the N2 or N3 neutralisation unit.

⚠ Make sure that you tighten the hose clamps sufficiently.

HN2-NH3



NEUTRALISATION UNIT TYPES HN2-NH3 (WITH PUMP)

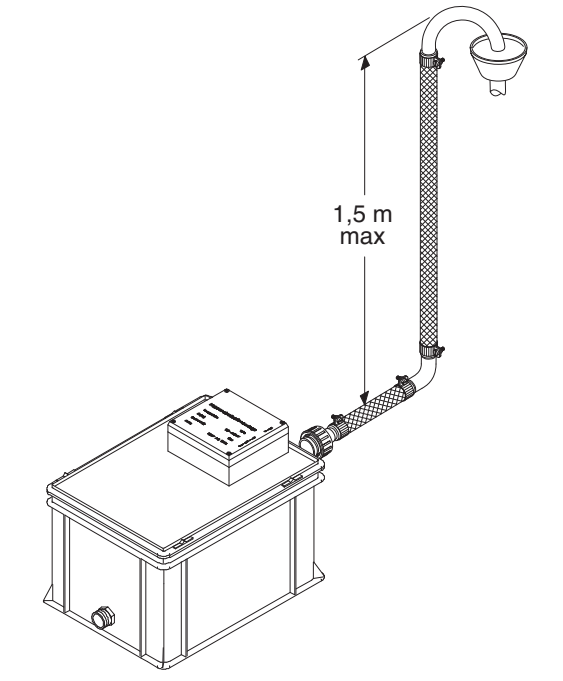
HN2 and NH3 neutralisation units are designed for systems with boiler condensate drain pits at a higher level than the boiler condensate drain fitting.
The maximum head that the pump can overcome is 3 metres. The pump is controlled by an electrical level switch in the HN2 and NH3 neutralisation units.
Refer to the instructions provided to connect these neutralisation units up electrically. These units have an electrical protection rating of IP44..

Type	Consumption (W)	Power supply (V~Hz)	Condensate flow (l/m) (*)	Dimensions (mm)	Quantity of granulate (kg)	Fitting Ø
HN2	50	230 ~ 50	12	400X300X220	25	1"
HN3	80	230 ~ 50	22	600X400X220	50	1" 1/2

(*) con battente = 3m

The inlet fitting (A) of HN2 and NH3 neutralisation units (the lower fitting) must be connected to the boiler condensate drain fitting using the flexible hose (C) supplied. This condensate drain hose is specially made to prevent combustion fumes escaping into the atmosphere.

The outlet fitting (B) of the neutralisation unit (the top fitting) must be connected to the boiler room's waste water drain pit using another section of flexible hose (not supplied).



IMPORTANT!
The boiler room's condensate drain pit must be located no more than 1.5 metres above the neutralisation unit.

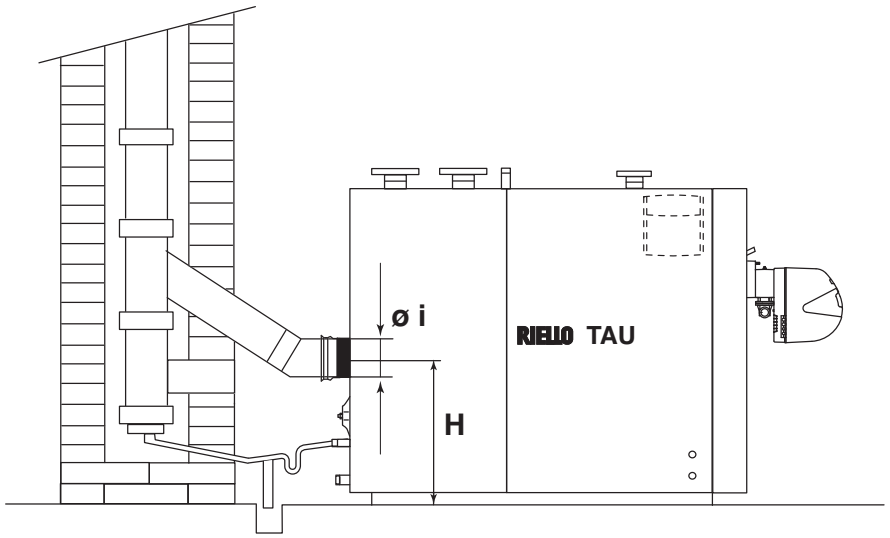
⚠ All connecting hoses must be kept as straight and as short as possible. Any curves or sharp bends can lead to the hoses becoming clogged and can therefore prevent proper condensate discharge.
Hoses should also be fixed to the floor and suitably protected whenever possible.

COMBUSTION GAS EXHAUST

The flue gas exhaust and stack connection must be made in compliance with applicable laws and standards, using heat resistant, condensate resistant and stress resistant rigid pipe and sealed joints.

The stack must be fitted with a condensate trap and drain and the flue gas exhaust pipe must be installed at a slope of at least 3° towards the boiler.

TYPICAL INSTALLATION SCHEMATIC



DESCRIPTION	BOILER model										
	150 N-NC	210 N-NC	270 N-NC	350 N-NC	450 N-NC	600 N-NC	800 N	1000 N	1250 N	1450 N	
H -Height of flue gas outlet	505	505	545	545	645	645	680	680	720	805	mm
Ø i -Diameter of flue gas fitting	200	200	250	250	300	300	350	350	400	450	mm

⚠ The stack must guarantee the minimum draught specified by applicable technical standards, assuming zero pressure at the connection to the flue.

⚠ Inadequate or badly dimensioned stacks and flues can increase combustion noise and affect combustion parameters.

⚠ Joints must be sealed using suitable materials (e.g. filler, mastic or silicon based sealant).

⚠ Uninsulated flue pipes are potentially dangerous and can cause burns.

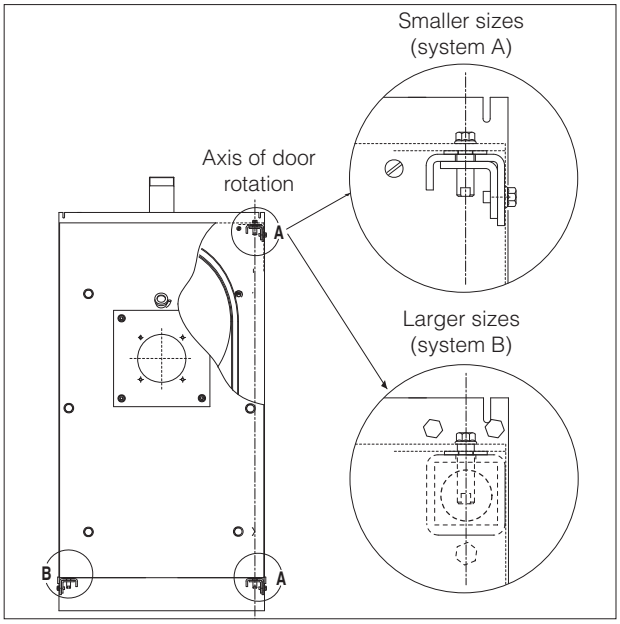
DOOR HINGES

TAU boilers are pre-fitted with three hinges so that the direction of opening of the door can be rapidly reversed.
Once you have checked that the default direction of opening is as required, or have reversed the direction of opening as instructed in the 'Changing the direction of door opening' section, remove the spare hinge assembly 'B' (screw, bushing and washer) opposite the pivot side of the door.

Two different door hinging systems have been used to satisfy varying constructional requirements:

System A (on the smaller sizes) - comes with a bracket and two hinge fixing nuts

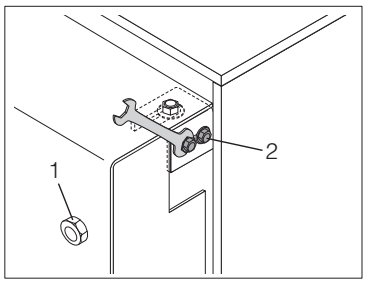
System B (on the larger sizes) - comes with a hinge fixing plate, a nut and an internal compression spring.

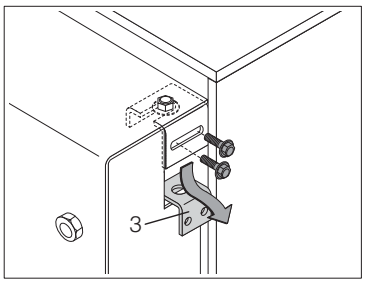


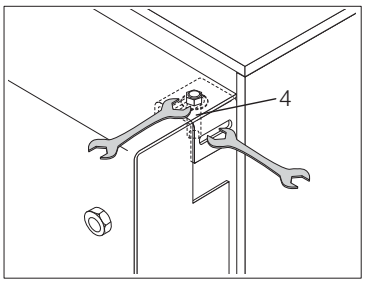
CHANGING THE DIRECTION OF DOOR OPENING

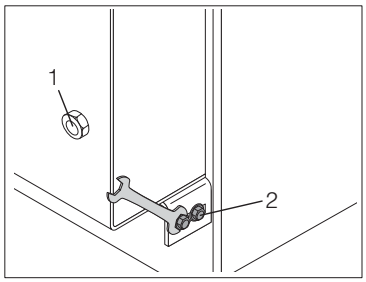
The boiler door hinges are factory fitted on the right of the door. If you need to reverse the direction of opening, remove the boiler's side panel and proceed as follows.

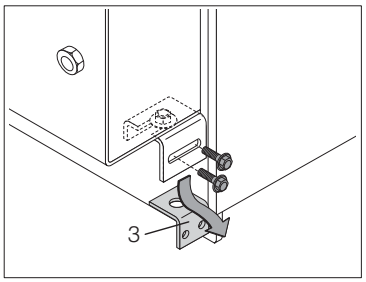
Smaller sizes (system A)

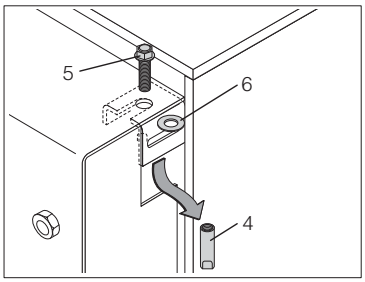










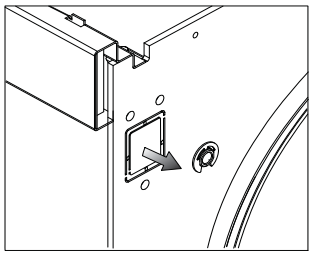


First ensure that the main door fixing bolts (1) are tight and then remove the safety bolts (2) and lift off the door fixing brackets (3).

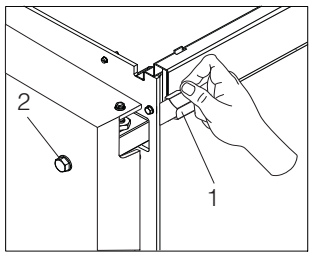
nsert a spanner through the top slot and hold the bushing (4) steady. Unscrew the top bolt (5), then remove the bushing (4) and washer (6).

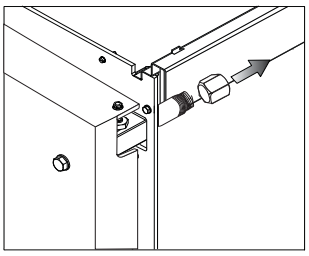
Reverse the above steps to fit the door on the opposite side.

Larger sizes (system B)

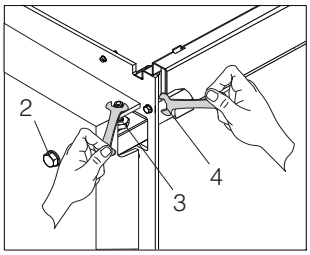


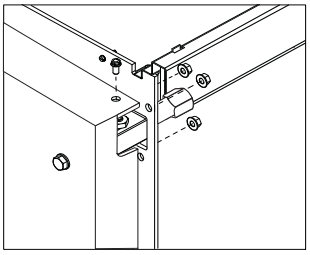
Open the door and with the aid of a small hacksaw or a file remove the knockout on the side opposite the leading edge of the door (both top and bottom). Then seal the door by tightening the bolts (2) so that the door is self-supported by compression against the packing.

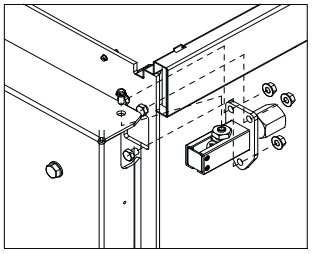


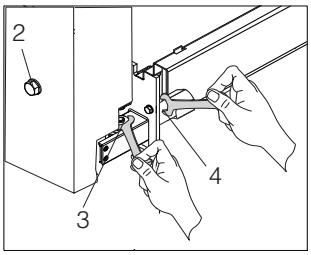


Remove the plug (1) taking care not to lose the compressed spring inserted in the threaded tube.

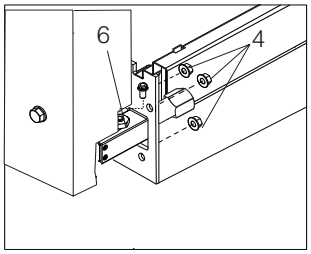


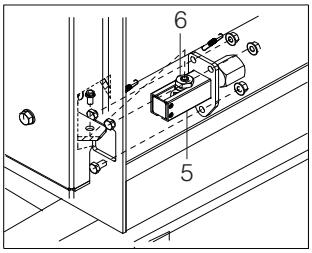






Remove the bolt (3) and the nuts (4)





remove the nuts (4) that secure the hinge plate (5) to the door and remove the plate.

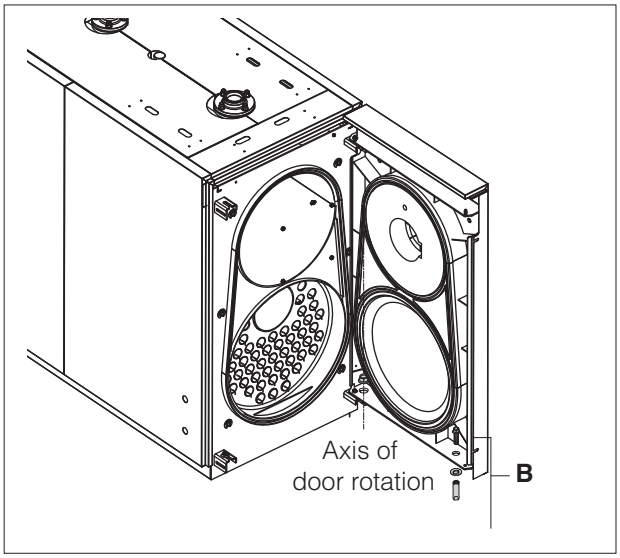
Remount the hinge plate on the opposite side, ensuring that the cylinder projecting above the nut (6) enters into its slot. If necessary tighten the nut (6) to raise it. Lastly, tighten the bolt (3).

REMOVING THE HINGE ASSEMBLY 'B'

System A

- First ensure that the side safety bolt (2) is tight and then remove the main fixing bolt (1).

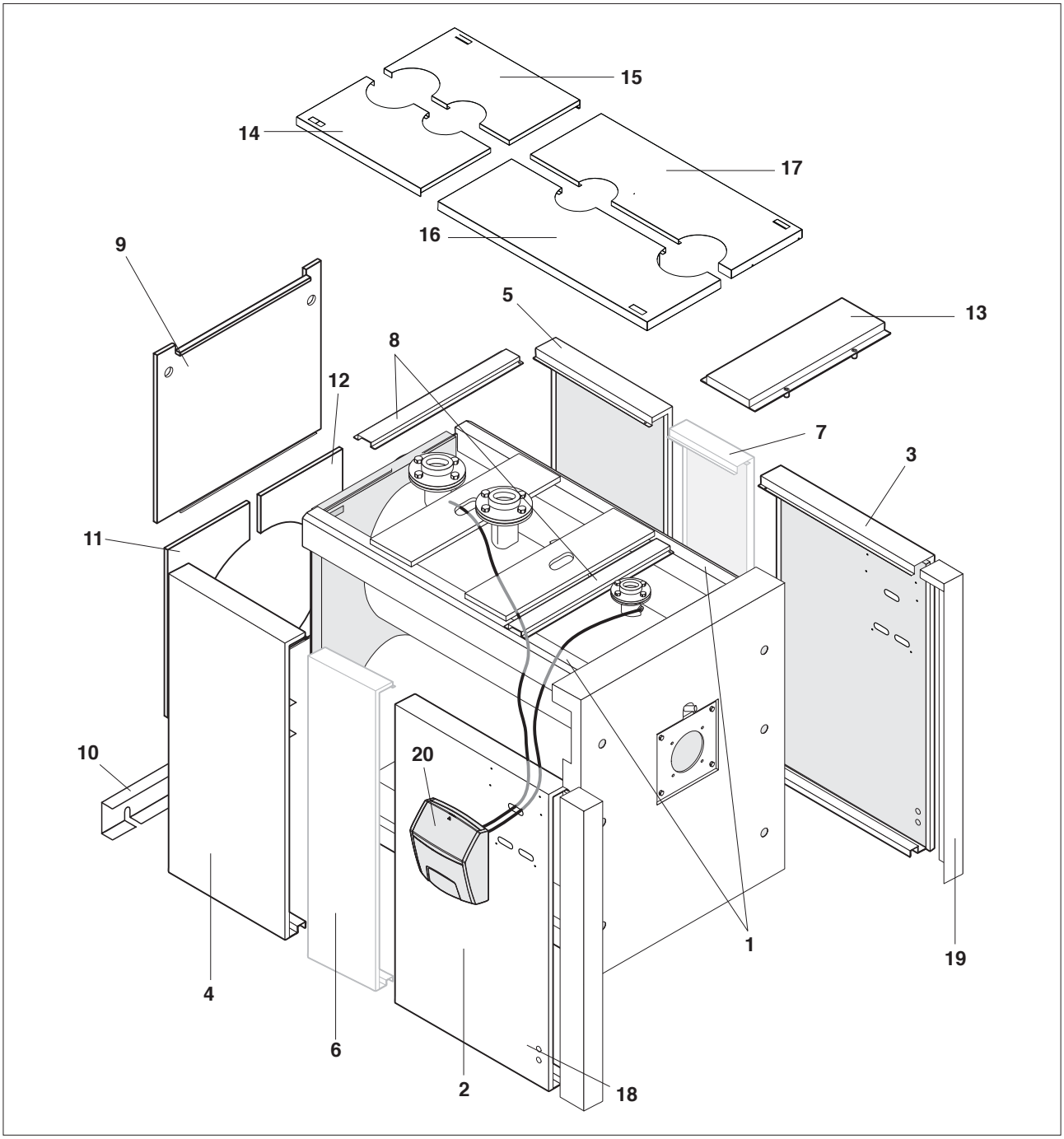
- With the door open, remove the hinge assembly 'B' (bushing, bolt, and washer) opposite the pivot side of the door.



FITTING THE PANELLING

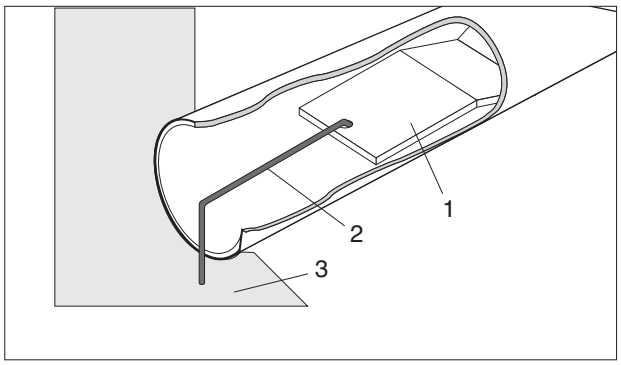
To mount the panelling, proceed as follows:

- Push out the pre-formed slots in the boiler's side panel (2) or (3) depending on what side you want to install the control panel) corresponding to the oval cable grommets in the control panel.
- Perforate the membranes of the control panel cable grommets. Route the electrical cables through them and insert the sensors in their sockets.
- Fix the control panel (20) to the boiler casing using the screws provided.
- Fit the front side panels (2) and (3) and rear side panels (4) and (5) over the boiler frame (1) and to the top side beams.
  On models 450 N-NC, 600 N-NC, 800 N, 1000 N, 1250 N, 1450 N, also fit side panels (6) and (7).
- Secure the side panels in place using the top cross beams (8) and the screws provided.
- Fit the top rear panel (9), the bottom rear bracket (10) and then the bottom rear panels (11) and (12). Fit the front top panel (13).
- Fit the top panels (14), (15), (16) and (17).
  Smaller models have only two top panels, one over the right and one over the left of the boiler.
- Finally, fit the front trim panels (18) and (19).

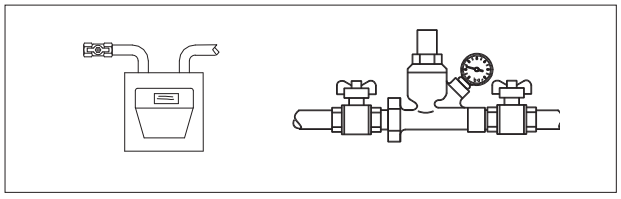


It is essential to perform the following checks before starting up or testing the functioning of the boiler. In particular, check that:

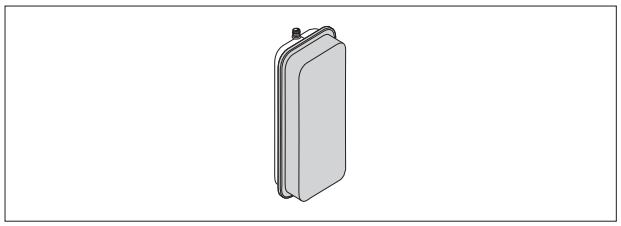
- The turbulators (1) are correctly positioned (horizontal) inside the heat exchanger tubes and the clips (2) are resting against the wall (3) of the heat exchanger.



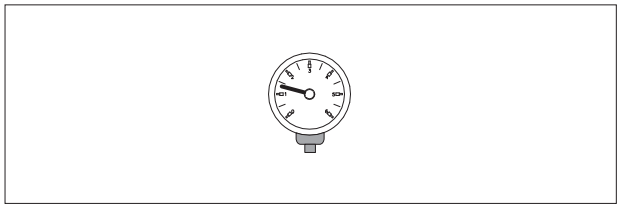
- The water and gas cocks are open.



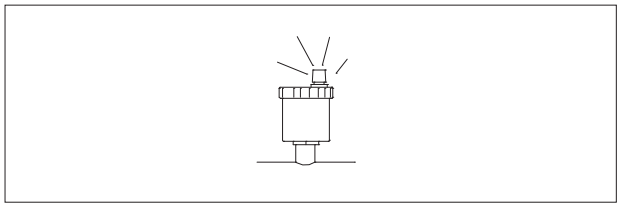
- The expansion vessel is properly charged.



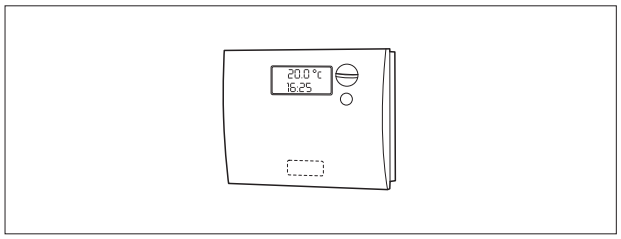
- The working pressure in the heating circuit is **over 1 bar** but below the maximum limit specified for the boiler.



- The water circuits have been properly bled.



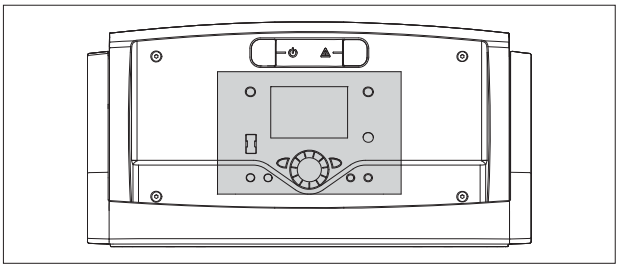
- The mains power connections to the boiler and its accessories (burner, pump, control panel, thermostats, etc.) have been properly made.



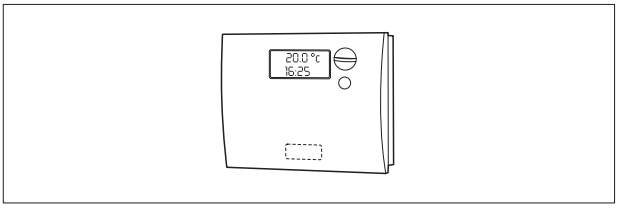
⚠ The phase-neutral polarity has been respected.
A ground (earth) connection is obligatory.

Once you have completed all the preparatory steps, proceed as follows to start up the boiler for the first time:

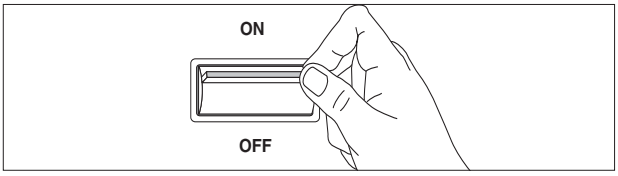
- Since the control panel incorporates a temperature control function, make sure that the control panel is switched on.



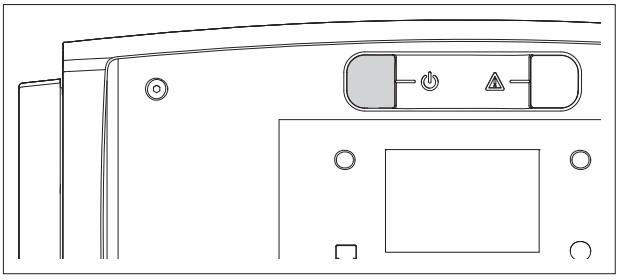
- Adjust the timer thermostat (if installed) or the temperature control to the desired temperature (~20° C).



- Turn the system's main power switch ON.



- Make the settings as instructed in the instruction manual for your control panel.
- Turn the control panel power switch ON and make sure that the green power indicator lights.



The burner should now ignite and remain in operation until the set temperature is reached.

If any ignition faults or malfunctions occur, the burner performs a 'LOCKOUT SHUTDOWN'. This is shown by the red button light on the burner and by the warning light on the control panel.

⚠ If a LOCKOUT SHUTDOWN occurs, wait about 30 seconds before resetting the burner.

To reset the burner, press the red button light on the burner and wait until the flame ignites.

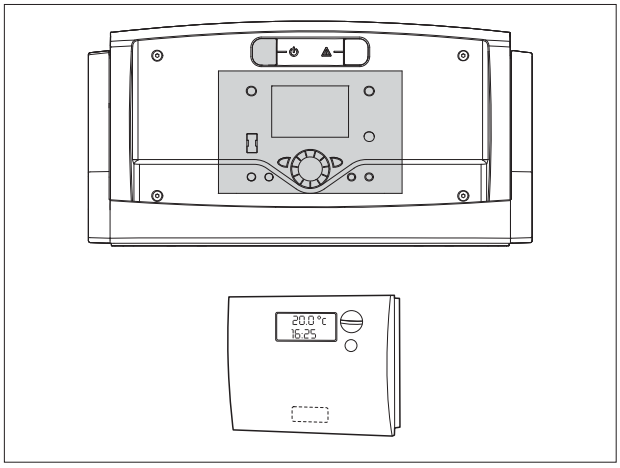
Repeat this operation 2 -3 times at the most. If the problem persists, perform the following checks:
- Check that all the instructions in the burner manual have been performed properly.
- Check that the instructions in the 'Preparing for Initial Startup' section have been performed properly.
- Check that all the electrical connections shown on the control panel wiring diagrams have been performed properly.

Once the boiler has started up, make sure that it shuts down and re-starts properly too. Proceed as follows:

- Set the boiler thermostat to the required setting (making sure that the temperature control is in manual mode).

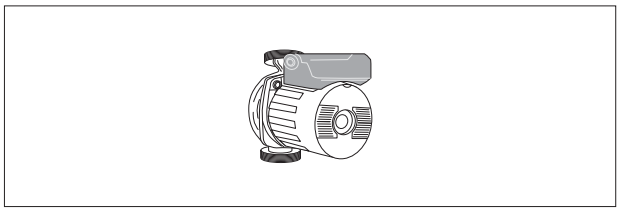
- Switch the control panel power switch off.

- Set the room thermostat or timer to the required temperature.

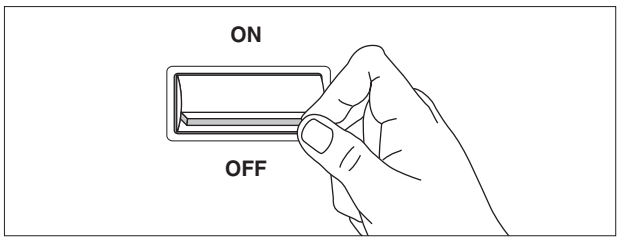


Make sure that there are no leaks around the boiler door seal. If you detect any leakage of fumes, increase the tightening of the door fixing bolts.

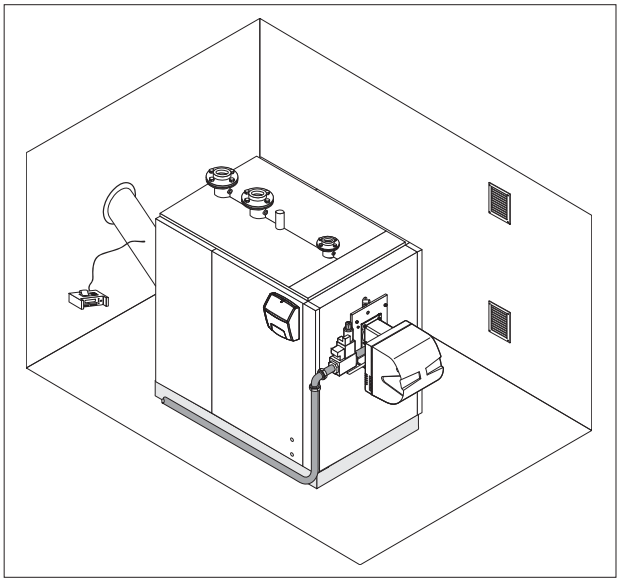
Make sure that all the pumps in the system are free and rotate in the right direction.



Turn off the main power switch to the boiler and make sure that the boiler shuts down properly.



Provided all the above conditions are satisfied, start the boiler up again, then analyse the combustion fumes and measure the gas flow.



Regular maintenance is one of the requirements of Presidential Decree 412 of the 26th August 1993. It is also essential for the safety, efficiency and durability of the boiler. Proper maintenance keeps consumption and emissions down, and ensures that the boiler continues to operate reliably over time.
Have your boiler serviced either by **RIELLO**'s Technical Assistance Service or by a qualified professional.

Analyse the combustion fumes before commencing any maintenance. The results of fume analysis can give a clear idea of what servicing or repairs are needed.

OPENING THE DOOR

- Turn the system's main power switch OFF
- Close all the gas cocks.

System A:
- Make sure that the safety bolts (1) on the side of the boiler are tight.

System A and B:
To open the door, simply remove the main fixing bolts (2) holding the door in place.

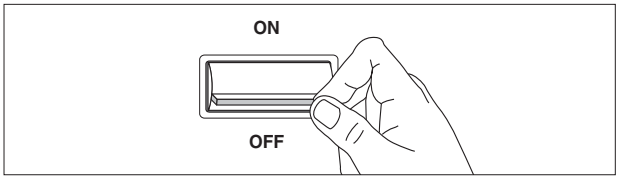
⚠ The first time you open the door, remove the spare hinge assembly 'B' (bushing, bolt, and washer) opposite the pivot side of the door.

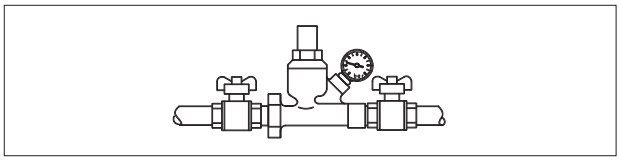
ADJUSTING THE DOOR
Make quite sure that the door presses uniformly all around the double seal to prevent dangerous fumes escaping into the air. Proceed as follows to adjust the door seals:

System A:
- Fit the door and tighten the main fixing bolts (2) until the seals start to compress.
- Loosen the safety bolts (1) then fully screw in the main door fixing bolts (2).
- Tighten the safety bolts (1).

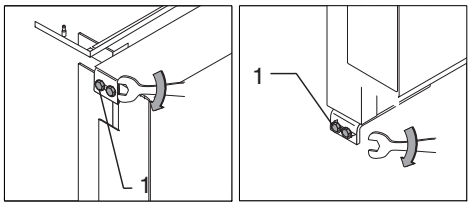
System B:
Put the door in its correct position and tighten the main locking screws (2) until the packing starts to be compressed

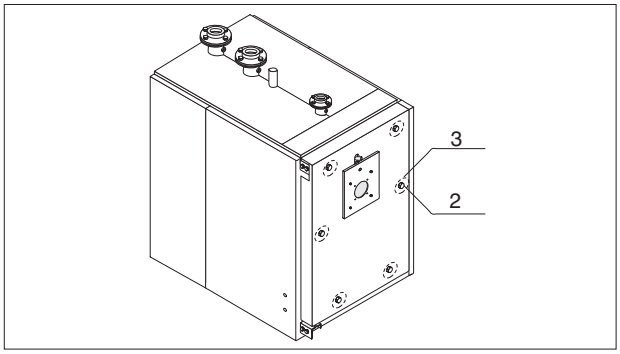
⚠ Make sure that the door is properly adjusted after every maintenance operation.

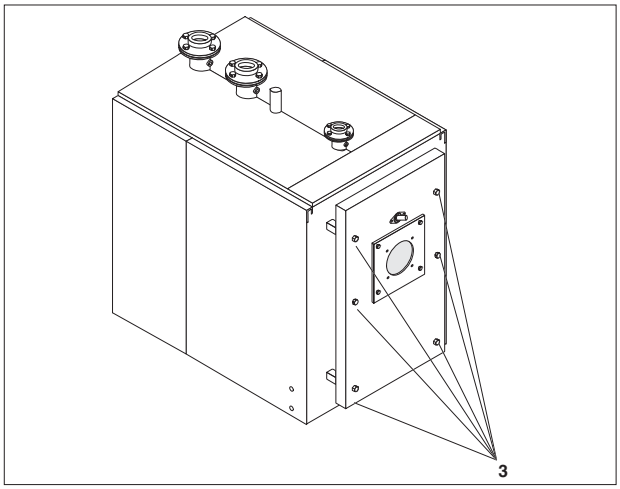




Smaller sizes (system A)





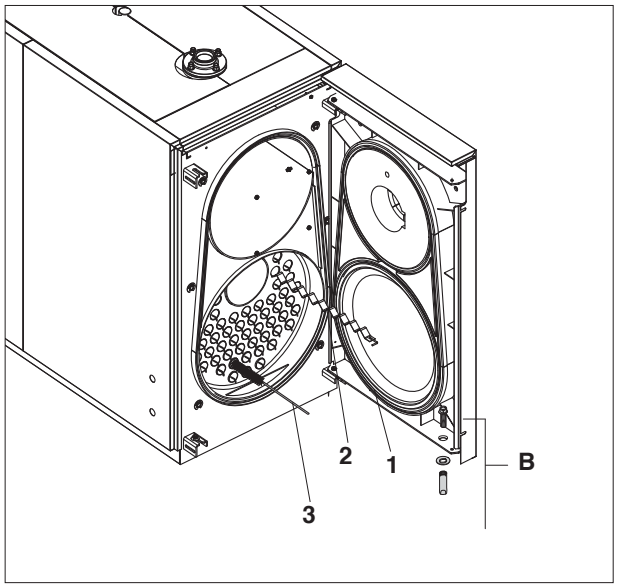


Clean the boiler and remove any carbon deposits from the surfaces of the heat exchanger **at least once a year.** This not only extends the boiler's working life, but also keeps it efficient in terms of heat output and consumption.

Proceed as follows to clean the boiler:

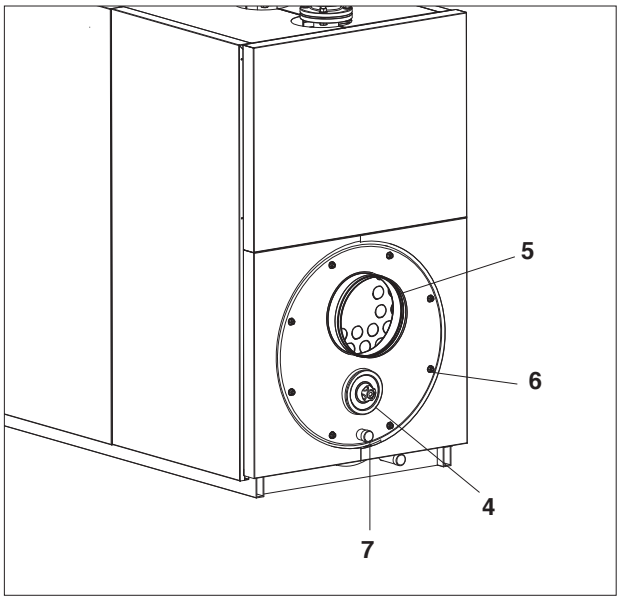
- Open the door (1) as instructed on page 34 and pull out the turbulators (2).

- Use a flue brush (3) or other suitable tool to clean inside the combustion chamber and the flue gas pipes.



- Open the inspection port (4) and clean out any deposits from inside the flue gas box.

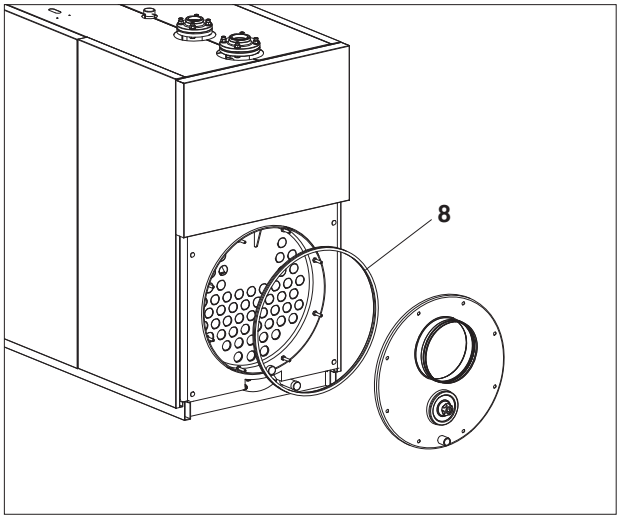
If more thorough cleaning is required, remove the outer panels, unscrew the eight fixing bolts and pull firmly on the flue gas box (5) to remove it from the boiler.



Check at regular intervals that the condensate drain (6) is not blocked.

If necessary, replace the seal (7).

Clean all removed components, then follow the above steps in the reverse order to refit them.



PROBLEM	CAUSE	CORRECTIVE ACTION
The boiler does not reach its set temperature	Heat exchanger dirty	Clean the flue gas pipes
	Heat exchanger and burner mismatched	Check specifications and settings
	Insufficient gas flow to burner	Check and adjust the burner
	Control thermostat problem	Check the functioning of the ther mostat Check the temperature setting
The boiler keeps shutting down, and the control panel warning light comes on	Control thermostat problem	Check the functioning of the thermostat Check the temperature setting Check the electrical wiring Check the sensor bulbs
	No water supply Air in the circuit	Check the circuit pressure Check the vent valve
The boiler has reached the set temperature but the radiators are still cold	Air in the circuit	Bleed the circuitia
	Pump malfunctioning	Check/release the pump
	Problem with minimum temperature thermostat (if present)	Check the temperature setting
There is a smell of fumes	Fumes are escaping into the air	Check that the boiler body is clean Check that the flue pipes are clean Check that the boiler, flue pipes and flue gas exhaust stack are all properly sealed
The safety valve keeps openinga	Excessive pressure in the circuit	Check the circuit pressure Check pressure reducer functioning Check pressure reducer setting
	Problem with heating system expansion vessel	Check the efficiency of the expansion vessel
There are traces of condensate on the rear head	Flue gas box seals	Check the seals between the rear head and the flue gas box

Extract from Italian standard UNI 8065:
'Water Treatment in Domestic Heating Systems'

The purpose of this standard is:
- to establish acceptable ranges for the chemical and chemical-physical parameters of water destined for use in domestic heating systems in order to ensure the efficiency, safety, durability, and correct functioning over time of all auxiliary appliances and to minimise energy consumption, in conjunction with other applicable laws and standards
- to lay down guidelines for the correct design and installation of water treatment systems
- to establish methods for testing and analysis as part of proper system operation even during periods of shutdown
- to define the technical qualifications and responsibilities of the purchaser, supplier and operator of water treatment systems

⚠ This standard assumes that water destined for use in domestic heating systems has characteristics similar to those of normal drinking water even prior to treatment.

The main chemical and chemical-physical characteristics of heating system water and their effect on system operation

Appearance
The appearance of water depends on the presence of sediment, in suspension or in colloidal form, and on the presence of dissolved substances that create easily identifiable conditions like turbidity, colouration or foaming.
These substances can lead to limescale, sludge, corrosion, abrasion, microbial growth and foaming.
Their presence in a heating system indicates either that the filling water has not been sufficiently purified and has been topped up, or that there are problems inside the circuit, (such as corrosion, leaks, etc.). It is essential to identify the source of any such impurities so that the correct remedial action can be taken.

Temperature
The temperature reached at different points in a heating circuit is extremely important, since it determines whether phenomena like limescale, corrosion and microbial growth will occur and how quickly they will develop.
Temperature must be accurately specified at all stages of the system design process, and must be checked carefully as soon as any malfunctioning is detected.

pH
The pH value, referred to 25°C, expresses how acidic or basic a solution is, in a scale from 0 to 14.

- 0 defines maximum acidity
- 7 defines neutrality
- 14 defines maximum basicity

pH is a fundamental parameter in evaluating how corrosive system water might be. It also represents an extremely important factor in the development of limescale, corrosion and microbial growth. Generally speaking, any pH value lower than the range specified in the 'Characteristics of filling and refilling water' section can cause generalised corrosion, while any pH higher than that range can lead to limescale, sludge and corrosion.

Fixed residues at 180°C - Electrical conductivity
Fixed residue offers a direct measurement by weight of the quantity of salts contained in a sample of water evaporated at 180°C.
Since the electrical conductivity of a water based solution depends largely on its salt content, electrical conductivity is often taken as an alternative measurement to fixed residue. Since conductivity is also influenced by temperature, any measurement taken with a conductivity meter must be referred to 25°C. Conductivity is expressed in microsiemens per centimetre (µS/cm).
As a practical means of measurement, it is assumed that fixed residue (expressed in mg/kg) corresponds to about 2/3 of the corresponding conductivity measurement (in µS/cm).

A high salt content can cause limescale, corrosion and sludge, and can also point to design errors or poor operating practices (e.g. insufficient bleeding) of the heating system or water treatment system.

Hardness
The total hardness of a water sample is an expression of the sum total of all the calcium and magnesium salts dissolved in it.
The temporary hardness value expresses the sum total only of calcium and magnesium bicarbonates.
Hardness is expressed in mg/kg of CaCO3 or in degrees 'French' (1°fr = 10 mg/kg $CaCO_3$) .
The use of hard water without suitable treatment can lead to the formation of limescale.

Alkalinity
M-alkalinity or total alkalinity represents the sum total of all alkaline salts (bicarbonates, carbonates, hydrates and alkaline phosphates) present in a water sample. P-alkalinity or phenolphthalein alkalinity expresses the content of hydrates and half the carbonates. The phenolphthalein alkalinity of naturally occurring water is normally zero. Alkalinity is expressed in mg/kg of $CaCO_3$.
High P-alkalinity values can lead to increases in pH, and are generally caused by inadequate venting and bleeding.

Iron
Copper content is expressed in mg/kg of Cu.
Free iron in a water circuit can lead to sludge and/or secondary forms of corrosion. If the iron content of the raw water supply exceeds the established limits, suitable pretreatment must be provided. Iron found in system water as the result of corrosion points to the fact that the heating system or the treatment system is not being operated properly.

Rame
Copper content is expressed in mg/kg of Cu.
The presence of copper in system water can cause dangerous localised corrosion.
Copper is seldom found in any appreciable quantity in raw water.
If it is detected, it is therefore the result of corrosive processes inside the heating circuit.
There is only any point in measuring the copper content of the water if the system actually contains copper components which might be corroding.

Chlorides and sulphates
These values are expressed in mg/kg of Cl and SO_4. respectively.
Since the system filling water is considered to be drinkable, no specific limits are laid down for chloride and sulphate content. These salts can nevertheless cause corrosion if they come into contact with certain metals (certain stainless steels in the case of chlorides and copper in the case of sulphates).

Microbial growth
A wide range of algae, fungus, mould and bacteria species can live and breed inside heating circuits. These microbes not only form living colonies of organisms but also cause corrosion and bad smells when they die and decompose.

Water analysis
Water must be properly analysed to identify the type of treatment it needs.

Typical heating system water problems and possible remedies

The purpose of establishing limits for certain parameters in water destined for use in heating systems is to eliminate or significantly reduce the problems typically caused by the use of unsuitable water.
Untreated water can seriously reduce the efficiency of a heating system and can cause serious wastage of energy. Typical problems include:

- limescale
- corrosion
- sludge
- microbial growth

These problems often occur together. Any solutions must suit the characteristics of the heating system in question.

Limescale
Limescale deposits are caused mainly by hard water salts precipitating out and covering the walls of a circuit in a more or less solid, hard coating.
Limescale reduces the efficiency of the heating system by reducing heat exchange and blocking pipes, and often leads to corrosion too.
Limescale can be prevented by chemically stabilising the water and/or softening it with ion exchange resin softeners.

Corrosion

Corrosion is generally an electro-chemical process. It begins by destroying the surface of a metal, but can go so far as to penetrate the metal completely.
Corrosion is promoted by the presence of oxygen and is triggered by unsuitable water characteristics or by non-homogenous conditions, caused, for example, by contact between different metals, non-uniform metallurgy in system components, solid substances coming into contact with each other, sludge, and system design and operating errors. Corrosion is also favoured by heat, high salt content (especially chlorides) and high water pumping speeds. Corrosion can be reduced by specific or generic chemical water conditioning.

Sludge
Sludge is formed by the precipitation of insoluble organic and inorganic substances.
Unlike limescale, sludge forms soft deposits. Sludge can be caused by the characteristics of the system water or by atmospheric pollution (especially if the heating circuit is open to the air). Sludge can give rise to the same problems as limescale.
Sludge can be prevented by filtering incoming water, by proper bleeding and venting, and by chemically treating the system water.

Microbial growth
In this context, the term 'microbial' refers to any form of organic life normally classified as algae, fungi, moulds and bacteria.
Their growth is favoured by light, heat, sludge and accidental pollution.
Perhaps the most dangerous microbes for a heating system are autotrophic bacteria (e.g. ferrobacteria and sulphate reducing bacteria). These are one of the direct causes of localised corrosion. Microbial growth can be prevented by using suitable biocides.

Note: This standard does not deal directly with the problems caused by microbial growth, but simply defines intrinsic water characteristics in order to identify suitable treatments. It is nevertheless essential to ensure that heating systems are installed to the highest standards. Failure to do so can lead to a wide range of problems.

Water treatment

Classification of water treatments
The types of water treatment that can be applied to heating system filling and refilling water are classified as follows:
- physical and chemical-physical treatments ('external' treatments)
- chemical conditioning ('internal' treatments)

Physical and chemical-physical treatments
Two forms of treatment are generally required if heating systems are filled from the normal water supply, or with drinking water:
- precautionary filtration to protect the boiler and water circuit
- softening in an ion exchange resin water softener

If the supply water is not normal drinking water, other specific pre-treatments may be needed.

Chemical conditioning
Chemical conditioning:

- stabilises water hardness
- disperses soft organic and inorganic sludge
- deoxygenates the water and passivates internal surfaces
- corrects alkalinity and pH
- forms a protective film
- controls microbial growth
- provides anti-freeze protection

Selecting the right treatment
Water treatments must be chosen to suit the characteristics of the water to be treated, the type of heating system and the required purity parameters. The various types of treatment (physical, physical-chemical, and chemical) can be used alone or in combination as required. It is the responsibility of the customer to define the characteristics of the treatment system he requires. It is then the responsibility of the supplier to offer a choice of suitable water treatment systems, enabling the customer to choose the actual system that best matches their technical and economic needs (bearing in mind initial cost, running costs and ease of operation). These responsibilities can, of course, be delegated to competent third parties acting as consultants, provided their responsibilities are agreed in advance by the parties.

Description of physical and chemical-physical treatments

Filtration

Purpose

In general, filtration is used to filter out undissolved substances by passing water through one or more filter elements. The elements themselves can be of various types (minerals of various grain size, ceramic or fibre filters, mesh filters, membranes, etc.).
There are two common types of filter for practical purposes and for the purposes of the present standard: those made from inert, washable granular materials of suitable grain size, and those made from disposable or washable filter elements.

Principle of functioning
a) Filters with washable granular filter materials

These are generally made in the form of closed containers (pressure filters) containing one or more layers of inert granular material. Suspended solid particles are filtered out of the water as it passes through the filter material
These filters need to be regenerated cyclically by backwashing, with or without the aid of compressed air.

b) Filters with washable or disposable elements

In this type of filter, suspended particles are mechanically removed by the small or tiny passages through the filter element. The element itself gradually becomes clogged and must be washed or replaced.

Resin softening

Purpose

Softening water with synthetic resins replaces the limescale forming or hard ions (calcium and magnesium) with other ions that do not form limescale (sodium).

Principle of functioning
Water softeners are closed tanks containing ion exchange resins (organic polymers) whose functional groups determine the unit's capacity for exchanging sodium ions for calcium and magnesium ions. The unit gradually loses its capacity for ion exchange and must be regenerated it intervals by adding normal kitchen salt (sodium chloride).
The cyclical phases of exhaustion and regeneration can be repeated almost indefinitely.

Chemical conditioning
The chemical conditioning of water in a heating system is achieved by adding suitable doses of chemical reactants to integrate (if necessary), or in certain cases replace, the filling water treatment originally performed with the physical and chemical-physical means described above.

Classification of conditioners

The following table lists the various types of chemical water conditioner, arranged according to action and characteristics of the most common product. Conditioners can be used alone or in combination with other products, if more than one effect is required.

Types of chemical conditioner

Action	Purpose	Type	Notes
Correction of alkalinity and pH	To maintain a pH that minimises the corrosive action of the water on the material it comes into contact with throughout the circuit	Non-volatile alkalinising agents: formulae based on phosphates, silicates, hydrates and sodium carbonate	
		Volatile alkalinising agents: formulae based on ammoniacal compounds and non-aromatic amines	
	To correct excessive alkalinity	Non-volatile de-alkalinising agents: formulae based on phosphates, sulphates and acid reacting sulphates	
Stabilisation of water hardness	To prevent the formation of insoluble salt deposits on heat exchange surfaces and to prevent the precipitation of insoluble salts in general	Sequestrants and complexants: formulae based on polyphosphates, phosphonates, EDTA, polycarboxylic acids etc.	
Precipitation of limescale forming salts	To promote the formation of insoluble compounds in the form of soft sludge	Inorganic precipitants: formulae based on phosphates	
Dispersion of soft sludge	To disperse undissolved compounds in order to prevent them sticking to the internal surfaces of the circuit	Natural or synthetic organic products: formulae based on tannins, lignins, polyacrylates, etc	
Deoxygenation of water and passivation of internal surfaces	To eliminate oxygen from the circuit and consequently create the conditions needed to form and preserve protective coatings over internal metallic surfaces (passivation)	Non-volatile de-oxygenating agents: formulae based on sulphates	
		Volatile de-oxygenating agents: formulae based on non-aromatic reducing amines	
Formation of protective films	To form a protective monomolecular film at the water-metal interface, thus blocking the corrosive action of the water and simultaneously discouraging the formation of limescale and microbial growth on internal surfaces	Volatile film-forming agents: formulae based on aliphatic polyamines	
Control of microbial growth	To prevent the development of algae, moulds, fungi and bacteria	Biocides: formulae based on quaternary ammonium salts, halogen derivatives, etc.	
Anti-freeze protection	To stop water freezing inside the circuit	Organic compounds: formulae based on passivated non-toxic glycol	

Dosing system
The dosing system must permit reactants to be added at the desired points in the heating system, and at the flow rates and at concentrations needed to maintain water parameters within the required ranges.
Conditioners must only be dosed into domestic hot water by means of dosing units capable of guaranteeing that dosing is always proportional to the water flow rate.

Choice and application of conditioners
The 'Characteristics of water destined for use in heating systems' section below provides a general introduction as to whether chemical conditioning is useful or necessary.
Precise instructions cannot be given because treatment details depend on the characteristics of the circuit in question.
In any case, it must be fully understood that conditioning is designed mainly to provide specific or polyvalent actions aimed at protecting the heating system against corrosion and limescale.

Reconditioning heating systems
The treatments listed above are designed to maintain system water in optimal operating conditions.
These treatments may also, over time, help recondition older systems that have been affected by non-serious limescale or corrosion.
If the corrosion or limescale has already reached a serious level, however, proper reconditioning must be performed by specialist personnel prior to the use of normal water treatments.

Characteristics of water destined for use in heating systems

This section lists minimum and maximum parameters for water destined for use in filling, refilling and operating heating systems.
Provision must be made right from the design stage for all the treatment and conditioning sub-systems needed to treat incoming water and produce water with the characteristics given below.

It is the responsibility of the system operator to perform all the checks and actions necessary to ensure that water parameters remain within the specified range at all times.

⚠ The establishment and maintenance of water parameters within the ranges specified guarantees compliance with the present standard. It is nevertheless essential to point out that compliance with this standard also depends on the correct design and operation of the entire heating system. Failure to design and operate systems correctly can lead to various problems that are often erroneously attributed to water characteristics. The main design problems to avoid are:

- lack of or inadequate temperature control
- contact between two or more different metals, or the incorrect sequencing of metal components
- excessive refilling of the heating circuit
- poor pipe jointing
- excessive water speed through the circuit
- circulation through open expansion vessels
- use of unsuitable materials
- inadequate venting

Hot water heating systems

Prescribed water treatments
Chemical water conditioning is required for all heating systems. The installation of a safety filter is obligatory in systems with a heat output above 350 kW (and advisable in all systems). If the total hardness of the water exceeds 15°fr, a softener must also be installed to bring the water back within the permitted hardness range.

Treatment points
Treatment systems must be installed upstream from the heating system they are designed to protect, and typically on the filling the refilling pipes, where they can treat the initial filling water and the water subsequently used to refill the system.
Water conditioning agents must be added at a point that ensures the rapid action of those agents. The ideal point of entry into the system is in the system's main flow, at a point of maximum turbulence, e.g. upstream from the pump.

Characteristics of filling and refilling water

Appearance	Clear
Total hardness	Less than 15°fr

Note: In heating systems of less than 350 kW in heat output, if the filling or refilling water has a hardness value of less than 35°fr, the water softening unit can be replaced by a suitable chemical conditioning unit.

Characteristics of circuit water

Appearance	Clear
pH	Higher than 7 (with radiators made from aluminium or light alloy elements, the pH must also be lower than 8).
Conditioners	Present in the concentration specified by the supplier.
Iron (Fe)	< 0,5 mg/kg
Copper (Cu)	<0,1 mg/kg

Checks
As is the case with checks for water parameters, it is the responsibility of the system operator to ensure that any water treatment systems are functioning properly, in compliance with instructions and at the specified intervals. The supplier's responsibility ends with the supply and commissioning of the right conditioning system for achieving and maintaining the required water parameters.

Advice on sampling

In order to arrive at a correct analysis of the chemical and physical characteristics of a water sample, sampling systems and methods must be capable of guaranteeing precision and repeatability.
The sampling system must, in addition, not add further contaminants to the sample.
For this reason it is preferable for the sampling system to be made from the same material as the pipe or tank in which it is installed. If the temperature of the water being sampled is hotter than 35°C, a cooling coil must also be provided to reduce its temperature to no more than 25°C.
Before taking the sample of water or steam for testing, bleed the sampling system for 5 minutes to eliminate any oxides or other materials in suspension that might have accumulated in it.
The sample container must likewise by made from an inert material compatible with the sample collected (e.g. glass or polyethylene).
Wash any containers thoroughly in the water to be sampled before actually taking the sample

Ordinary analysis and checking, frequency and sampling points

The following symbols and terms are used to identify sampling frequency and the location of sampling points:

Frequency of analysis	A- Twice a year, in the season in which the heating system is in use
	B- Once a month
	C- Once every 15 days
	D- Once a week
Sampling points	1- Filling water
	2- Filling and/or refilling water
	3- Water in the boiler or heating circuit

The following table lists the sampling frequencies and sampling locations for the various types of heating system

Type of system Analyses and checks	Hot water heating system	Notes
Appearance	2A- 3A	
pH	3A	
Total hardness	2B	
Fixed residue		Electrical conductivity measurement can be used instead
Electrical conductivity		Fixed residue measurement can be used instead
Iron	3A	
P-alkalinity		
Chemical conditioner	3A	
Copper	3A	

Recommendations and requirements

Recommendations and requirements for the customer
The customer must provide the following details in order to permit the supplier to identify and supply the systems, appliances and chemical conditioners needed to treat the water correctly:

- characteristics of the system: type (heating, domestic hot water), delivery/flow rate, pressure, working temperature, power rating
- schematic of the circuit
- characteristics of the water available to supply the system
- state of preservation of the boiler and heating circuit (cleanliness, limescale, corrosion, etc.)

On completion of commissioning, responsibility for operating the system passes entirely to the customer, who must implement all the checks and actions necessary to maintain water parameters within the specified ranges.

Recommendations and requirements for the supplier
As part of the offer and subsequent supply of an external treatment system, conditioner dosing system and chemical conditioners (internal treatment), the supplier must:

- ensure that the information supplied by the customer, and especially the information provided on the characteristics of the water supply, is sufficient to identify the right treatment, and in case of doubt must perform the necessary analyses for himself
- offer the customer the most suitable treatment but also clearly state any viable alternatives
- explain any chemical-physical limitations on the use of the chosen treatment, specify what performance can be expected (if a system is supplied) or what minimum and maximum concentrations must be maintained (if a chemical product is supplied), and specify what methods of analysis must be applied
- in the construction of any dosing systems, use only components and materials suitable for use with the chosen conditioners, or provide all the details necessary to identify the same

In particular, suppliers of chemical conditioners must provide the customer with a data sheet listing the chemical characteristics, performance and toxicological properties of any product.

- specify the right method for adding conditioners to the system, and specify concentrations, points of entry, frequencies, dosing times and any other information necessary or useful for the proper use of the conditioners and treatment system
- during final commissioning, check that all the specified water parameters are respected
- specify what technical assistance and after-sales service can be supplied.

Cod. 20014315

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Instructions for the correct disposal of the product pursuant to European Directive 2002/96/EC

At the end of its working life, the product cannot be disposed of as municipal waste. It can be delivered to separate waste collection centres operated by local councils, if such exist, or to the resellers that provide this service. Separate disposal of appliances avoids possible negative consequences for the environment and the health due to unsuitable disposal and allows the recovery of the components, with significant savings in terms of energy and resources. The symbol (crossed-out wheeled bin) shown on the product indicates that the appliance must be disposed of separately.

RIELLO

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