Radijator INŽENJERING

ISO 9001:2008
TÜVRheinland CERTIFIED
www.tuv.com ID 9105067711

**Kotao na čvrsto gorivo/ Solid fuel heating boiler**

**Serije PK/ Series PK**


# INSTRUKCIJE/ Instruction manual

Montaža,korišćenje i održavanje kotla / Assembly, use nad maintenance of heating boiler

# Sadržaj:

# 1. Važna upozorenja

## OPŠTA UPOZORENJA

- Nakon uklonjenog pakovanja uveriti se u kompletnost isporuke, i u slučaju nedostataka, obratiti se prodavcu koji je prodao kotao.
- Kotao mora biti upotrebljen isključivo za namenu koju je predvideo proizvođač. Isključuje se bilo kakva odgovornost od strane proizvođača za štetu uzrokovanu osobama, životinjama ili stvarima, u slučaju grešaka pri montaži, regulaciji, održavanju ili nepravilnom korišćenju.
- U slučaju curenje vode prilikom punjenja instalacije, zatvoriti napajanje vodom i obavestiti ovlašćeni servis ili ovlašćenog montera.
- Ovo uputstvo je sastavni deo uređaja i mora se čuvati sa pažnjom i mora ***UVEK*** pratiti uređaj i u slučaju promene vlasnika ili korisnika ili u slučaju priključenja na drugu instalaciju. U slučaju oštećenja ili nestanka tražiti novi primerak od ovlašćenog prodavca.

## VAŽNA UPOZORENJA

Podsećamo da korišćenje kotlova na čvrsto gorivo zahtevaju poštovanje sigurnosnih mera i to:

- Zabranjeno je korišćenje kotla od strane dece i osoba sa ograničenim mogućnostima bez pratnje.
- Zabranjeno je korišćenje kotla na instalacijama sa radnom temperaturom većom od 110˚C, i radnim pritiskom većim od 3 bara.
- Zabranjeno je korišćenje lako zapaljivh goriva (alkohol, nafta) radi bržeg paljenja drveta
- Zabranjeno je odlaganje lako zapaljivih materijala u blizini kotla i u blizini vrata za loženje. Pepeo se mora odlagati u zatvorene i nezapaljive spremnike.
- Zabranjeno je spaljivanje otpada i materijala čije sagorevanje prouzrokuje plamen ili opasnost od eksplozije (npr. plastične kese, piljevinu, ugljenu prašinu, blato itd.).
- Zabranjena je izmena na sigurnosnim elementima.
- Zabranjeno je zatvaranje ventilacionih otvora na prostoriji u kojoj se nalazi kotao. Ventilacioni otvori su neophodni za pravilno sagorevanje.
- Zabranjeno je izlaganje kotla atmosferskim neprilikama. Sam kotao nije predviđen za spoljnu montažu i ne sadrži sistem protiv smrzavanja.
- Zabranjeno je isključivanje kotla ukoliko spoljna temperatura može da padne ispod NULE (opasnost od smrzavanja).
- Voditi računa o položaju klapne sigurnosnog vazduha (detaljnije objašnjenje u poglavlju ***START RADA KOTLA***).

- Rad sa uređajem kotla zabranjen je ljudima sa posebnim potrebalam (uključujući i decu) kako fizičkim tako i mentalnim, osim uz nadzor staratelja i ljudi koji su odgovorni za njihova ponašanja.
- Deca moraju biti pod nadzorom staratelja kako se ne bi igrala sa uređajem kotla.

## 1.1.Minimalna udaljenost od zapaljivih materijala

- Obezbedite odgovarajuću udaljenost od zapaljivih materijala, ako je potrebno obezbediti zaštitu istih.
- Minimalna udaljenost od zapaljivih materijala je propisana zakonom- molimo da se o tome raspitate kod stručnih lica, koja se bave grejanjem, i dimničara.
- Minimalna udaljenost kotla i cevi za odvod dimnih gasova od slabo i prosečno gorivih materijala treba da bude najmanje 100mm.
- Minimalno rastojanje od lako zapaljivih materijala je 200mm, a isto važi i za materijale čija zapaljivost nije poznata.

**Opasnost od požara!**

- Skladištenje zapaljivih materijala i tečnosti u blizini kotla je zabranjeno.

- Obavezno upozorite korisnike o potrebnoj minimalnoj udaljenosti zapaljivih materijala od kotla.

| Zapaljivost građevinskih materijala | |
|---|---|
| A ... nezapaljivi | azbest, kamen, građevinski kamen, keramičke zidne pločice, terakota, malter, cementna glazura (bez organskih dodataka) |
| B ... koji nisu lako zapaljivi | gipsane kartonske ploče, staklena vlakna, ploče od AKUMINA, IZOMINA, RAJOLITA, LIGNOSA, VELOKSA i HERAKLITA |
| C1 ... slabo gorivi | bukovo i hrastovo drvo, kompozitno drvo, filc, ploče od HOBREKSA, VERZALITA, UMAKARTA |
| C2 ... prosečno gorivi | drvo bora, tise i jele, kompozitni materijali |
| C3 ... lako zapaljivi | Asfalt, karton, celulozni materijali, iverica, pluta, poliuretan, polistiren, polipropilen, polietilen, podna vlakna |

# 2. Opis kotla serije „PK“

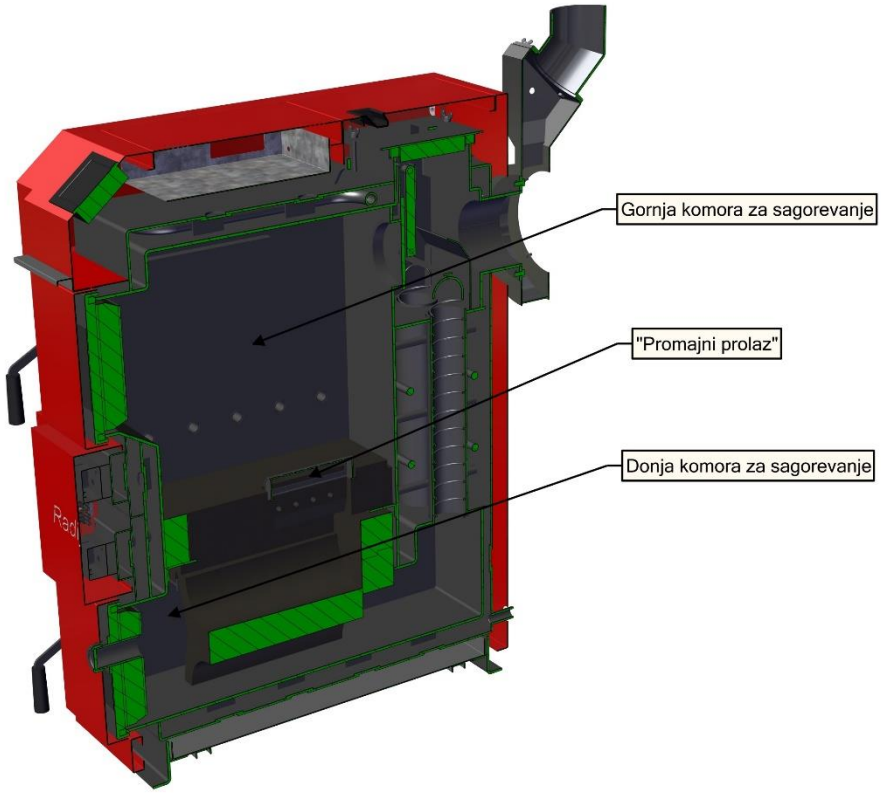
Kotao **PK 18** je razvijen sa ciljem da **RADIJATOR INŽENJERING DOO** ponudi tržištu kotao koji je po svojim mehaničkim i termičkim osobinama izrazito predviđen za pirolitički proces sagorevanja drveta**.** Principom pirolize gorivo temeljno sagoreva i to vrlo ekološkim principom gasifikacije drveta čime se značajno uvećava stepen korisnosti i smanjuje nivo štetnih emisija u okolinu u odnosu na tradicionalne principe sagorevanja.

Princip sagorevanja se odvija u dvodelnom ložištu u više faza. Gorna i donja komora su međusobno razdvojene "promajnim prorezom" od vatrostalne keramike.

U gornjoj komori se smeštaju drva. U nju se pravilno slažu cepanice drveta, čija je minimalna dužina veća od ***"promajnoj proreza"*** , dok je maksimalna 50cm. Za optimalne rezultate i najveći stepen korisnosti preporučuje se stepen vlage u drvetu od oko 15%-20%. U gornjoj komori se odvija proces pirolize odnosno "gasifikacije" drveta.

U donjoj komori se odvija glavni proces sagorevanja i donja komora je dodatno zaštićena pojasom od zaštitne vatrostalne keramike.

***Princip rada kotla (Slika 1):*** Nakon što se raspali vatra u kotlu (klapna ložišta je zatvorena,dok je prvobitno bila otvorena kao i klapna primara) drvo se najpre dodatno isušuje. Kada se formira plamen otvara se klapna sekundarnog vazduha. Proces gasifikacije drveta tom prilikom se započinje u gornjoj komori i pri tome se oslobađaju uglovodonični gasovi koji usled promaje u kotlu teže da prodru u donju komoru kroz "promajni prorez" kotla. Deo tih gasova sagoreva već u gornjoj komori, dok deo gasova zajedno sa teže sagorivim česticama sagororeva u donjoj komori gde je temperatura oko 1100°C.




*Slika 1. Gornja i donja komora za sagorevanje i "promajni prorez"*

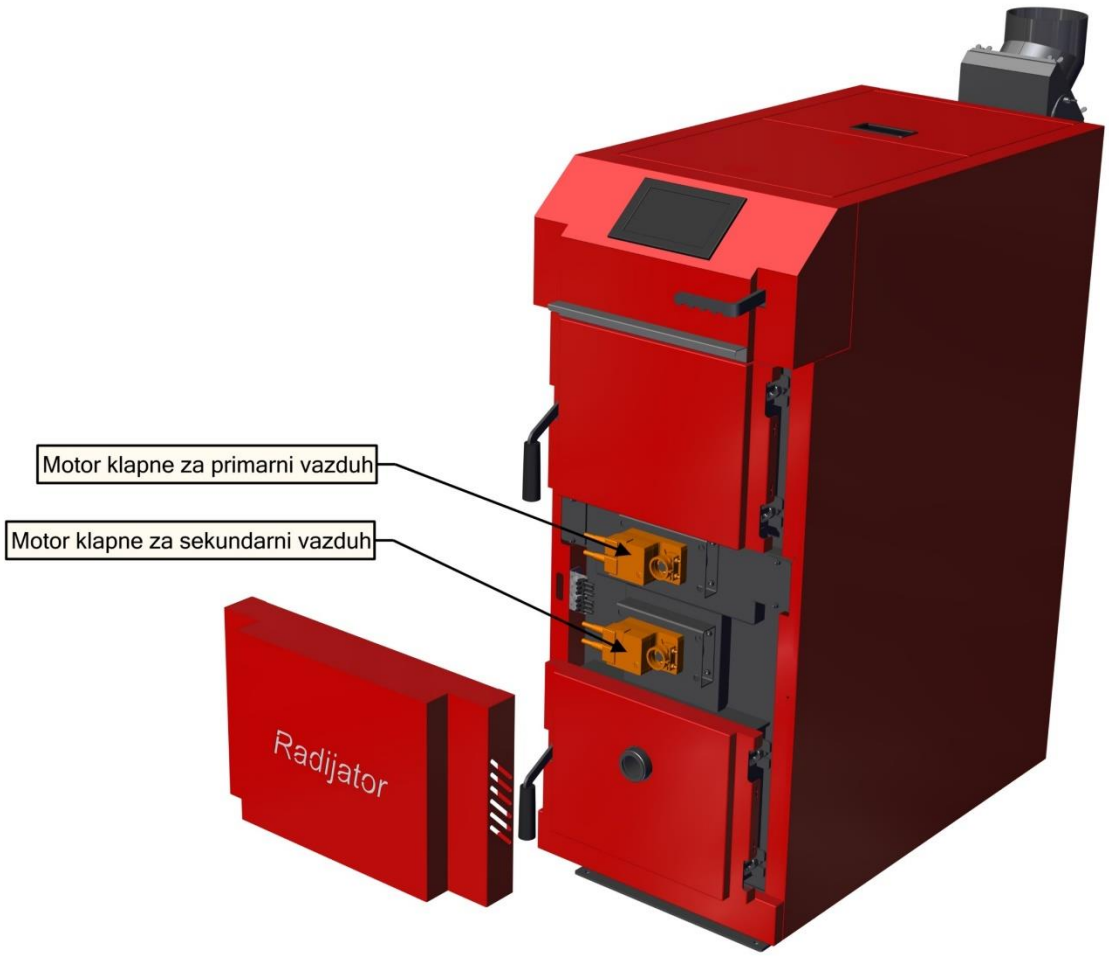
Na ovaj način zanemarljiv deo stetnih nesagorelih čestica dospeva u dimovod i otuda smanjeni nivo štetnih emisija koji je po svim standardima i normama Evropske Unije što se tiče emisija.

Ovakvim sagorevanjem se postiže najveći mogući stepen iskorišćenja, a kotao ima veći stepen korisnog dejstva.

Temperatura izlaznih gasova kod ovog tipa kotla je niža nego temperatura kod standardnih kotlova na čvrsto gorivo. Ovo može dovesti do pojave kondenzata ako se kotao ne koristi na ispravan način, zato pažljivo pročitati deo ***START RADA KOTLA I ČIŠĆENJE***, a takođe preporučuje se i ugradnja mešnog ventila na povratnom vodu kotla.

Za optimalno iskorišćenje energije, kao i za komfor pri korišćenju (broj loženja je redukovan na apsolutni minimum, jedan do dva puta dnevno) savetuje se dodatna ugradnja akumulatora toplote. Za 1kW toplotne snage kotla preporučuje se 55l zapremine akumulatora toplote, tako da, uz naš PK 18 idealna je akumulacija od 1000l.

Prilikom korišćenja navedenih goriva podrazumeva se automatska kontrola glavnih parametara rada. Regulacija rada se obavlja preko automatike koja se nalazi na gornjem delu kotla i njom se reguliše rad motora koji upravljaju klapnama za primarni i sekundarni vazduh ***(Slika 2).***




*Slika 2. Motori klapni za primarni i sekundarni vazduh*

## 2.1. Nominalna snaga pirolitičkog kotla PK 18 je 18kW.

Po spoljašnjem dizajnu, dimenzijama ložišta, otvorima za loženje i čišćenje PK 18 je zadržao sve dobre osobine predhodnih modela po kojima je RADIJATOR INŽENJERING prepoznatljiv na tržištu.

Velika vrata i ložište kotla omogućavaju loženje krupnim drvetom, takođe i jednostavno čišćenje i održavanje. Vreme trajanja jednog loženja je najmanje 4h pri nominalnoj snazi kotla. Kotao ima mogućnopst održavanja žara do 12h, tako da u tom periodu nije potreban ponovni proces potpale, već ako se želi samo se nastavi sa loženjem

Vodeni deo kotla, njegov način izmene toplote između dimnih gasova i vode, prilagođen je drvetu. Zbog primene ventilatora, tj. prinudne promaje put dimnih gasova duži je nego kod standardnih kotlova. Iz istih razloga moguća je primena usmerivača dimnih gasova tzv. turbulatora koji dodatno povećavaju stepen iskorišćenja kotla.

Stepen korisnosti je preko 90%. Pri normalnim režimima temperatura dimnih gasova na izlazu je oko 160℃ , a pri maksimalnim režimima je ispod 210℃. Ove vrednosti mogu u svakom trenutku da se očitaju na displeju. Tokom rada dolazi do stvaranja naslaga gareži i pepela na izmenjivačkom delu kotla i to značajno utiče na slabiju izmenu i porast temperature dimnih gasova. Ako se kotao ne čisti duže vreme moguć je toliki porast temperature dimnih gasova da dolazi do ulaska u modulacijski režim rada. Svi delovi vodenog dela kotla izrađeni su od bešavnih cevi kvaliteta **ST 35.4** i kotlovskih limova debljine 4 do 5 mm, u zavisnosti od snage kotla. Limovi su kvaliteta **1.0425 EU** standard odnosno **P265GH** standard **EUII.**

# 3. Montaža

## 3.1. Opšta upozorenja

**Kotao mora biti pravilno postavljen zbog pravilnog rada!**

Kotao se isporučuje sa spoljnom oblogom koja sadrži izolaciju. Kotao mora biti tako postavljen da bude omogućen pristup kotlu sa svih strana radi čišćenja i održavanja. (dalje u **tački 3.3**).

Za normalan rad potrebno je dovođenje svežeg vazduha u kotlarnicu (**tačka 3.3**), takođe za normalan rad kotla potrebno je da dimnjak bude popisanih karakteristika i izrađen od šamotnih cevi propisanog prečnika (**tačka 3.4**).

**Maksimalni radni pritisak kotla je 3 bar-a, minimalni 1 bar, a maksimalna radna temperatura kotla je 110℃.**

**Kotao na čvrsto gorivo treba instalirati prema važećim normama i zakonskim propisima.Svaka izmena na mehaničkoj konstrukciji smatraće se narušavanjem garancijiskih uslova i dovešće do njenog narušavanja.**

**Prilikom montaže na hidrauličku instalaciju kotao mora biti obezbeđen na propisan način od prekoračenja maksimalne radne temperature i pritiska.**

**Za propisnu montažu odgovoran je instalater centralnog grejanja koji priključuje kotao na hidraulički sistem.**

**Radijator inženjering DOO ,kao proizvođač kotla, ne preuzima nikakvu odgovornost za štete prouzrokovane lošim instaliranjem kotla.**

Osnovni zahtevi koje treba ispoštovati prilikom montiranja su:

- Kotao može da bude priključen na otvoreni sistem centralnog grejanja,ali i na zatvoren sistem centralnog grejanja. U slučaju priključenja na zatvoreni sistem ,preporučuje se ugradnja ventila za termičko osiguranje oticanjem,što je određeno i odgovarajućim zakonima svake države u kojoj se kotao priključuje.
- Kotao mora da se nalazi na sigurnoj udaljenosti od lako zapaljivih materijala.
- Priključenje na dimnjak takođe se radi prema obavezujućim propisima kao i preporukama proizvođača što se može videti u narednom tekstu.

## 3.2. Mere i uređaji bezbednosti kod kotla serije “PK”

Za bezbedan rad kotla serije „PK” potrebno je ugraditi sledeće elemente i potrebno ih je održavati ispravnim:

- Ventil sigurnosti na pritisak, odzračni ventili i manometar;
- Ventil termičkog osiguranja oticanjem.

Ventil sigurnosti na pritisak *(Slika 3),* odzračni ventili *(Slika 4)* i manometar *(Slika 5)*:


*Slika 3. Sigurnosni ventil*

*Slika 4. Odzračni ventil*


*Slika 5. Manometar*

- Ventil sigurnosti na pritisak mora biti nazivnog prečnika 1/2 cola baždaren na maksimalno 3 bara. Ovaj sigurnosni element koji spada u grupu limitatora pritiska mora da bude takve konstrukcije da izdrži i kratkotrajna prekoračenja i temperature i pritiska kao i određen sadržaj glikola u tečnosti za grejanje. Obično na istom mestu se priključuju još i odzraka ***(Slika 4)*** i manometar ***(Slika 5)*** tako da ova tri elementa zajedno sačinjavaju sigurnosnu grupu i montiraju se preko „T’’ priključka. Ovaj sigurnosni element mora da podleže i periodičnim ponovnim baždarenjima o čemu investitor tj. korisnik kotla mora da poseduje validnu dokumentaciju.

- Ventil sigurnosti mora biti montiran na najvišoj tački kotla i direktno na kotlu bez bilo kakvog cevovoda ili bilo kojih drugih elemenata između. Za ovu svrhu postoji i posebno predviđen priključak. Strogo je zabranjeno bilo kakvo reduciranje prečnika ovog priključka.

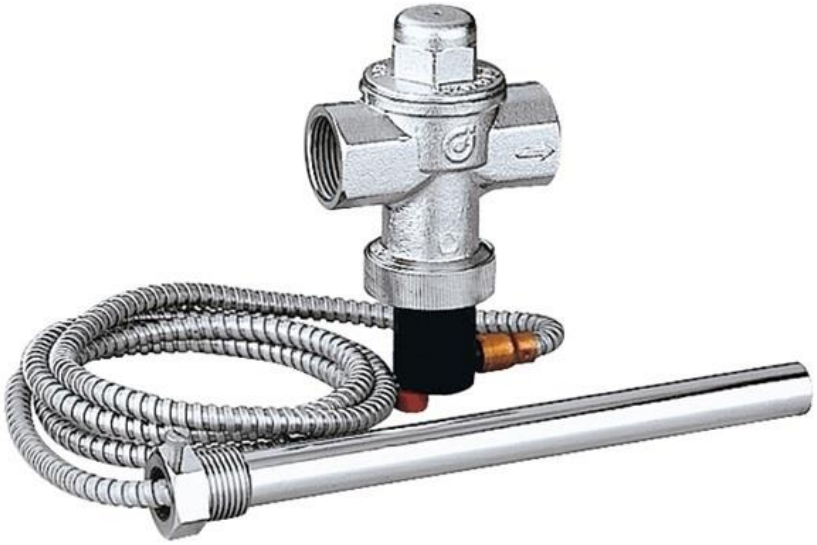
- Ispusni tj. izduvni deo ventila sigurnosti mora da bude od cevi čiji je prečnik najmanje jednak nazivnom prečniku ispusnog dela ventila. Takođe dozvoljeno je za njegovu izradu koristiti najviše jedan luk radijusa $r > 3d$.

- Sigurnosni ventil mora posedovati nazivnu pločicu i na njoj sledeće podatke:
  - naziv proizvođača,
  - oznaka tipa sigurnosnog ventila/godina ispitivanja,
  - nazivni protok,
  - podatak za koji toplotni učinak je sigurnosni ventil podešen,
  - najviši pritisak otvaranja tj. 3 bara.

- Obavezna je provera ispravnosti rada u određenim vremenskim periodima kao i ponovna baždarenja od strane sertifikovanih firmi. Ove obaveze se sprovode u skladu sa zakonom svake zemlje u kojoj je kotao namontiran. Obavezno čuvati pisani dokument o podacima zadnjeg baždarenja sigurnosnog ventila.

- Na povratnom vodu montirati barem još jedan ventil sigurnosti na pritisak.

Ventil termičkog osiguranja oticanjem *(Slika 6)*



*Slika 6. Ventil termičkog osiguranja*

Ovaj sigurnosni element ima takođe ulogu ograničivača temperature. U daljem tekstu biće označen sa skraćenicom VTO.

- U nekim ekstremno opasnim situacijama prelaz vode u vodenu paru je takav da ventili sigurnosti za pritisak nisu dovoljni da obezbede sigurnost hidrauličkog sistema. Iz ovog razloga je obavezna ugradnja VTO. U zavisnosti od zakonskih regulativa zemalja u kojima se kotao montira, VTO je potrebno ugraditi samo za snage veće od određenih ili za svaku snagu kotla obavezno ugraditi VTO.

- Mesto ugradnje prikazano je na šemi montaže kotla na instalaciju i na **Slici 7**. Do VTO-a se dovodi hladna sanitarna voda. Kada sonda VTO-a ima

informaciju da je temp. preko 95 stepeni VTO se otvara i voda prolazi kroz bakarnu spiralu.Posle izvesnog vremena temp. vode u kotlu se vraća na normalnu.

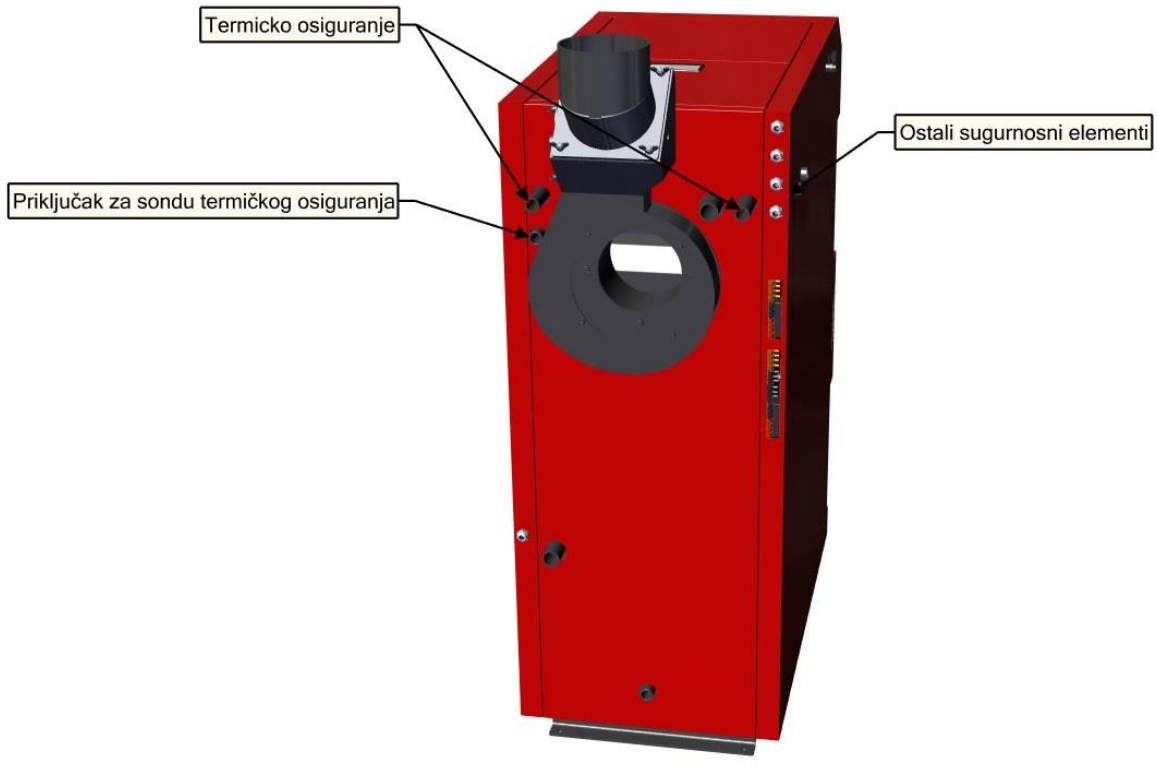
- Jedan priključak spirale koristimo za VTO a drugi za ispust vode koja je prošla kroz spiralu.Koji je priključak spirale za VTO a koji je ispusni je nebitno. Obavezno je pridržavati se uputstava ugradnje koje je dao proizvođač VTO

- Obavezno u određenim vremenskim periodima proveravati funkciju VTO.

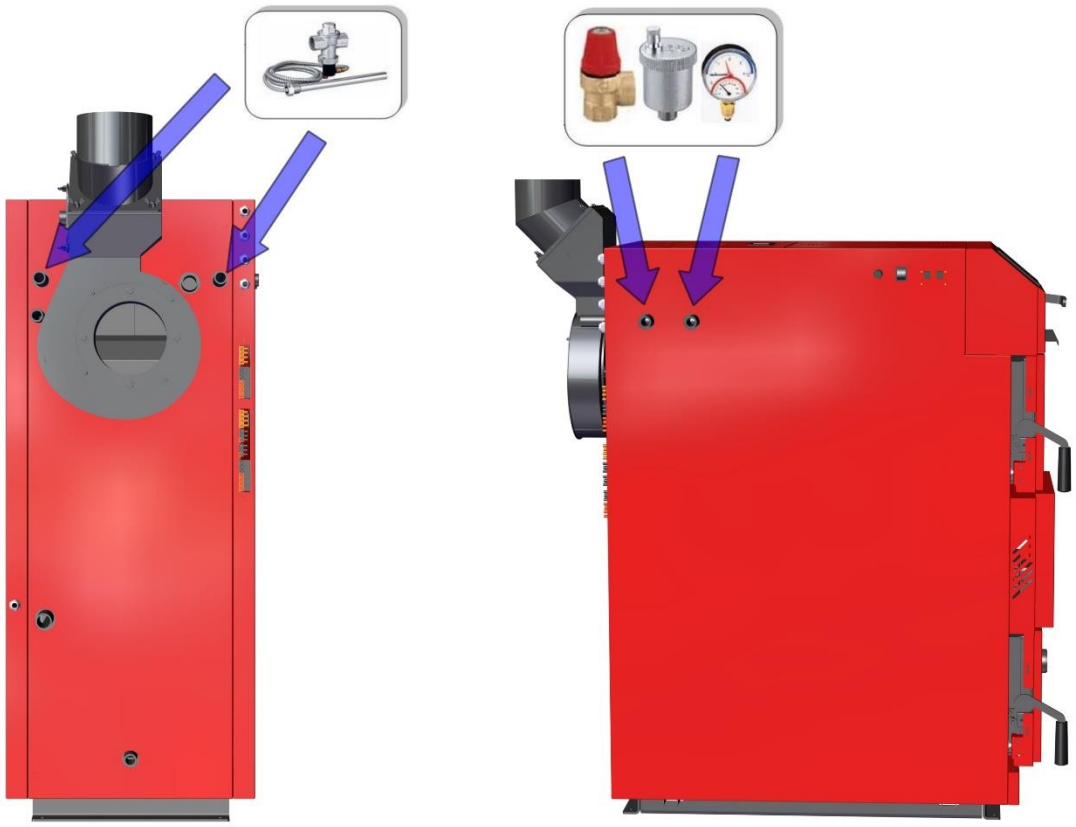
Kao što je već rečeno jedan kraj VTO je za montažu na izmenjivač kotla a do drugog se dovodi hladna voda pod pritiskom. Naročito je bitno da protok te vode bude neometan i pri nestanku el. energije.

**Ukoliko je nemoguće obezbediti dotok hladne sanitarne vode i pri nestanku el.energije,obavezno kotao priključiti na otvoren sistem.**

**Ukoliko je sanitarna voda koja je dovedena na ventil termičkog osiguranja preko dodatne pumpe, obavezno kotao priključiti na otvoren sistem.**




*Slika 7. Prikaz postavljanja sigurnosnih elemenata*



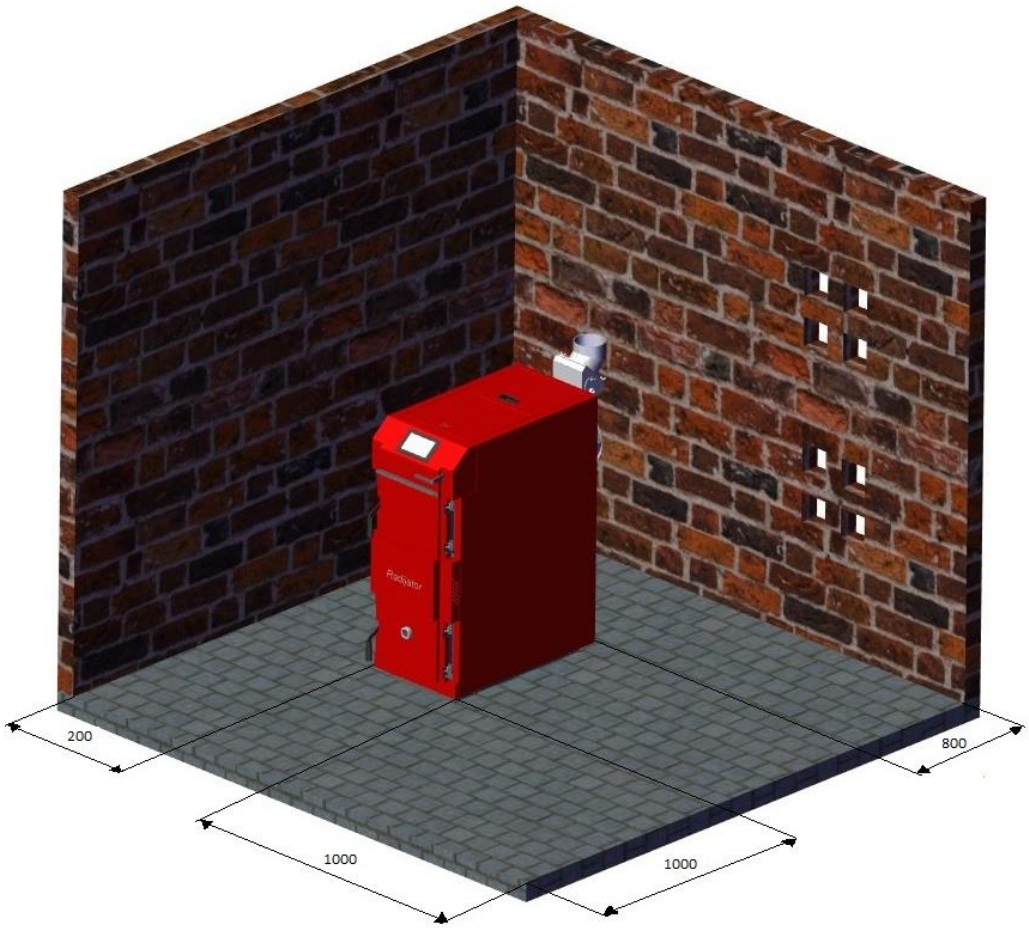
*Slika 8. Prikaz postavljanja sigurnosnih elemenata*

## 3.3. Kotlarnica

**Kotlarnica mora biti obezbeđena od smrzavanja!**

Podloga za kotao u kotlarnici mora biti od nezapaljivog materijala. Preporučene vrednosti udaljenosti sve četri strane kotla u odnosu na zidove kotlarnice ili neka druga kruta tela (akumulacioni bojler itd.) prikazane su na **Slici 9**. Ove vrednosti udaljenosti omogućavaju siguran pristup prilikom loženja, dovoljan prostor za čišćenje i nesmetan pristup ventilu za punjenje i pražnjenje.

**Kotlarnica mora da poseduje dovoljne otvore za ventilaciju kako za svež vazduh tako i za odvođenje istrošenog vazduha.**




*Slika 9. Pozicioniranje kotla u kotlarnici*

Ukupna površina ovih otvora je minimalno 150cm² za snage do 50kW a za snagu preko 50kW površina mora biti veća za jos 2cm² po kilovatu.

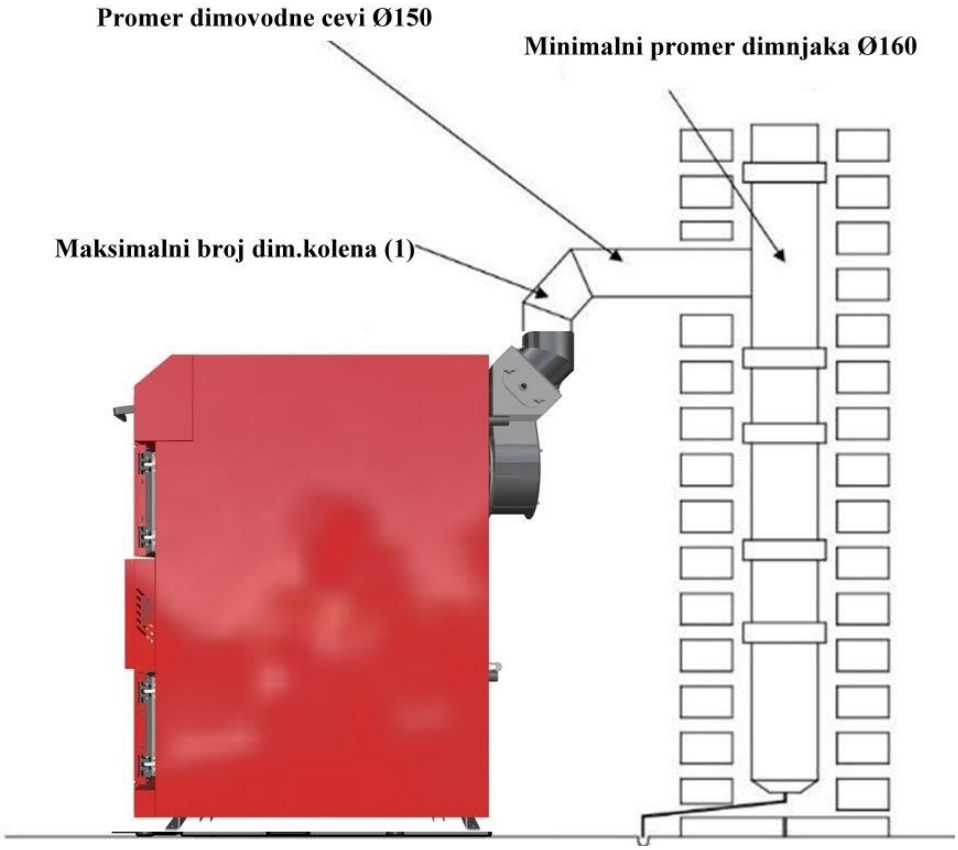
$$A=150cm^2+\frac{2cm^2}{kW}\times(\sum Q_n-50kW)$$ $\sum Q_n$ = moguće snage preko 50kW.

Nedostatak dovoljne ventilacije u kotlarnici može da uzrokuje više problema u radu kotla.Glavni problem je nemogućnost postizanja visokih temperature izlažne vode tj.ne postizanje maksimalne snage što dovodi do kondezovanja u kotlu.

- Uzeti u obzir neophodan minimalni prostor koji je potreban za prilaz sigurnosnim elementima i za izvršenje operacija čišćenja.
- Zabranjeno je izlaganje kotla atmosferskim neprilikama.Sam kotao nije predviđen za spoljnu montažu i ne sadrži sistem protiv smrzavanja.
- Zabranjeno je zatvaranje ventilacionih otvora na prostoriji u kojoj se nalazi kotao.Ventilacioni otvori su neophodni za pravilno sagorevanje.

## 3.4. Priključenje na dimnjak

Najoptimalnije postavljanje kotla na dimnjaču je takvo da prava koja spaja centar izlaza dimnih gasova iz kotla i centar priključenja na dimnjak bude u blagom usponu (do 3%) (***slika 10***).



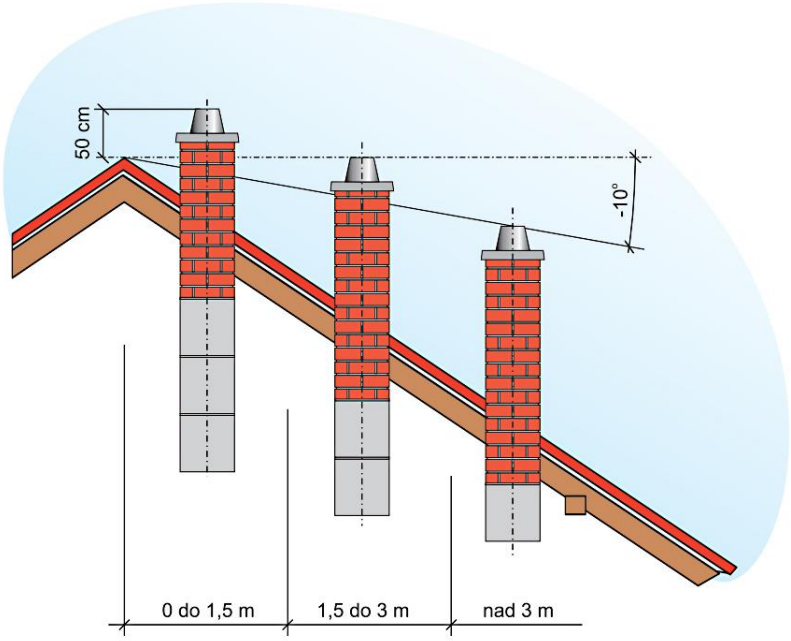

*Slika 10. Prikaz priključenja kotla na dimnjak*

Treba izbegavati ako je moguće lukove,a ako nije onda je maksimalni broj lukova (2). Dimni kanal od kotla do dimnajka poželjno je izolivati, posebno ako ima lukova i dužih deonica.

Sam dimnjak treba da je napravljen od keramičkih cevi, oko njih treba da je izolacija debljine 3-5cm i zadnji spoljni sloj je cigla ili specijalni dimnjački elementi.

Ako dimnjak ipak nije od keramike vec od cigle, povrsina svetlog preseka takvog dimnjaka mora da bude 30% veca nego ovakva površina keramičkog dimnjaka. Minimalna visina dimnjaka je 7m.

Dimnjak mora da ima i vratanca za čišćenje a ona moraju dobro da dihtuju. Izlaz dimnjaka na krovu mora da bude po određenim propisima. Razlikuju se dva slučaja: ako je ugao krova manji od 12° i ako je ugao krova veci od 12°. Za ugao manji od 12° visine dimnjaka iznad krova je 1m a za ugao veci od 12° treba pogledati skicu.



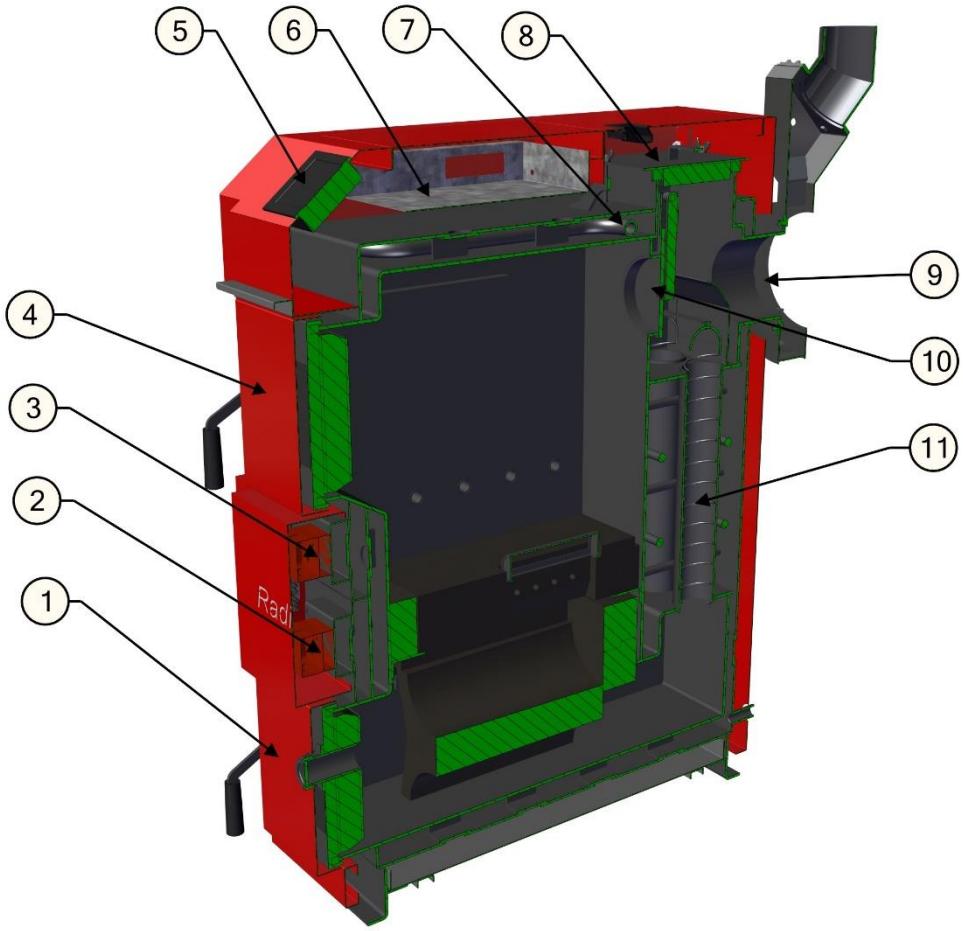

*Slika 11. Propisane dimenzije dimnjaka*

Ukoliko mislite da je dimnjak prejak i da isuviše hladnog vazduha prolazi kroz kotao,na izlazu iz kotla postoji klapna kojom može da se smanji protok izduvnih gasova. Dimnjak treba redovno da se čist ili barem jedanput godišnje.

***Ukoliko dimnjak nije propisne visine,poprečnog preseka ili ako se ne čisti moguće su komplikacije u radu kotla.Pre svega nije moguć visokotemperaturni rezim rada,tj.nema maksimalne radne snage,a posledice toga je pojava kondezacije što utiče na radni vek kotla.***

***Slab dimnjak je glavni razlog da u toku potpale kotla ili u toku rada imamo pojavu dima na gornjim ili donjim vratima,naročito pri većim brojevima obrtaja ventilatora.***

# 4. Presek PK kotla sa opisom elemenata

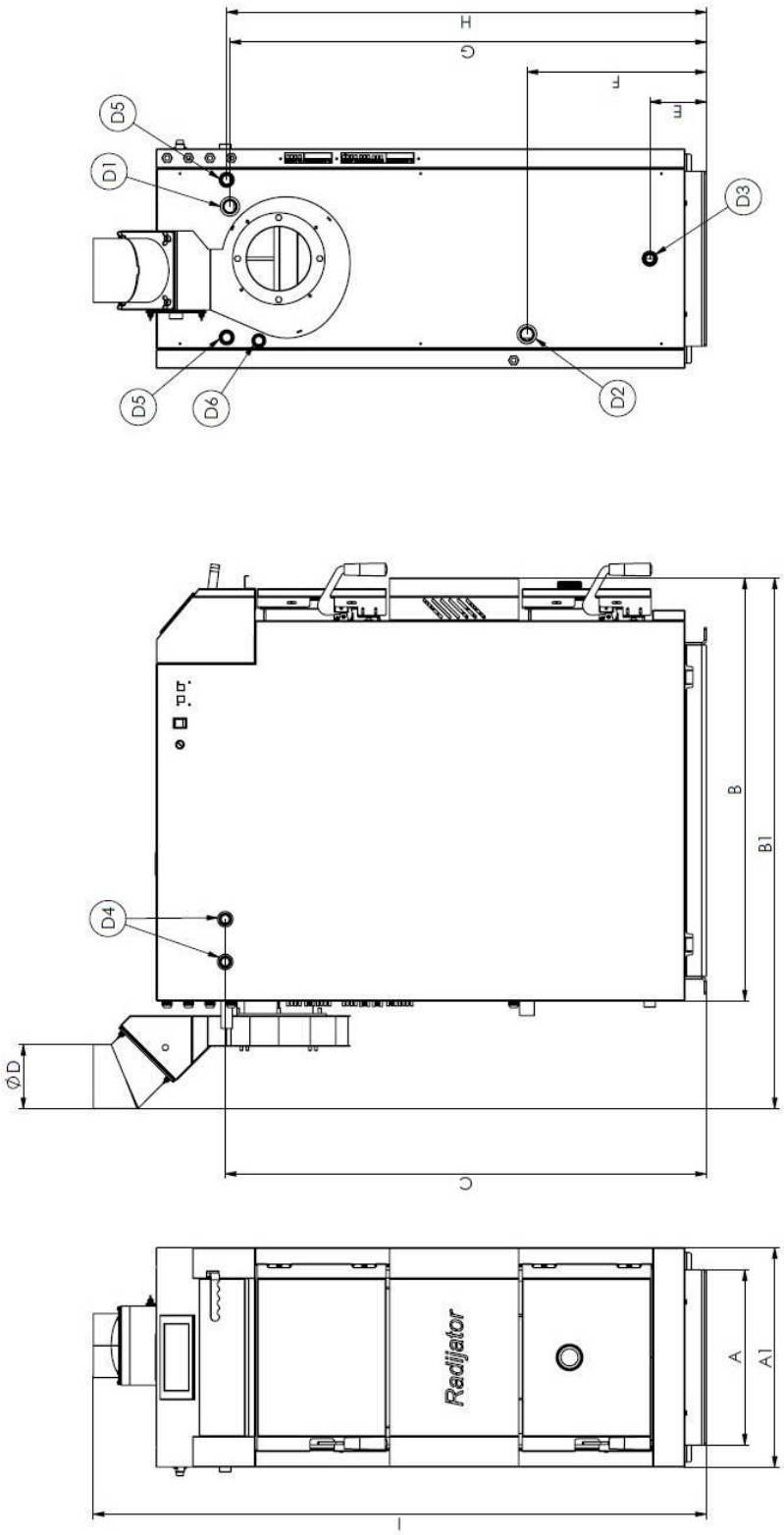



*Slika 12. Presek kotla PK 18*

1. Donja vrata,
2. Gornja vrata,
3. Motor za klapnu primarnog vazduha,
4. Motor za klapnu sekundarnog vazduha,
5. Automatika,
6. Nosač automatike,
7. Termičko osiguranje,
8. Poklopac otvora za čišćenje i demontažu turbulatora,
9. Dimnjača,
10. Klapna ložišta,
11. Turbulatori.

# 5. Tabela sa tehničkim podacima

| TIP KOTLA | | *PK 18* |
|---|---|---|
| **CE oznaka** | | **CE** |
| **Klasa kotla po EN 303-5:2012** | | **V** |
| **Radni pritisak** | bar | **3** |
| **Probni pritisak** | bar | **4,5** |
| **Zapremina ložišta** | L | **83** |
| **Zapremina vode u kotlu** | L | **100** |
| **Težina** | kg | **425** |
| **Poprečni presek dimnjaka** | mm | **150** |
| **Potrebna promaja dimnjaka** | mbar/Pa | **0,12/12** |
| **Temperatura kotla (min/max)** | °C | **60-90** |
| **Minimalna temperatura povratnog voda** | °C | **60** |
| **Stepen iskorišćenja** | % | **90,3** |
| **Nominalna snaga** | (kW) | **18,07** |
| **Emisija CO pri nominalnoj toplotnoj snazi (10%$O_2$) *** | (mg/m³) | **126,57** |
| **Emisija $NO_x$ pri nominalnoj toplotnoj snazi (10%$O_2$) *** | (mg/m³) | **175,75** |
| **Emisija OGC pri nominalnoj toplotnoj snazi (10%$O_2$) *** | (mg/m³) | **5,02** |
| **Prašine pri nominalnoj toplotnoj snazi (10%$O_2$) *** | (mg/m³) | **18,44** |
| **Dimenzije** | | |
| | A | **410** |
| | A1 | **514** |
| | B | **990** |
| | B1 | **1242** |
| | C | **1124** |
| | D | **150** |
| | E | **132** |
| | F | **419** |
| | G | **1113** |
| | H | **1120** |
| | I | **1409** |
| **Priključci za toplu vodu iz kotla** | D1 | **1"** |
| **Priključci za hladnu vodu iz kotla** | D2 | **1"** |
| **Priključci za punjenje i pražnjenje kotla** | D3 | **1/2"** |
| **Priključci za odzračivanje i ventil sigurnosti na pritisak** | D4 | **1/2"** |
| **Priključak za ventil termičkog osiguranja oticanjem VTO** | D5 | **3/4"** |
| **Priključak za sondu termičkog osiguranja** | D6 | **1/2"** |




*Slika 13. Projekcija kotla sa dimenzijama*

**** NAPOMENA: Ovo su izmerene vrednosti tokom sertifikovanja.***

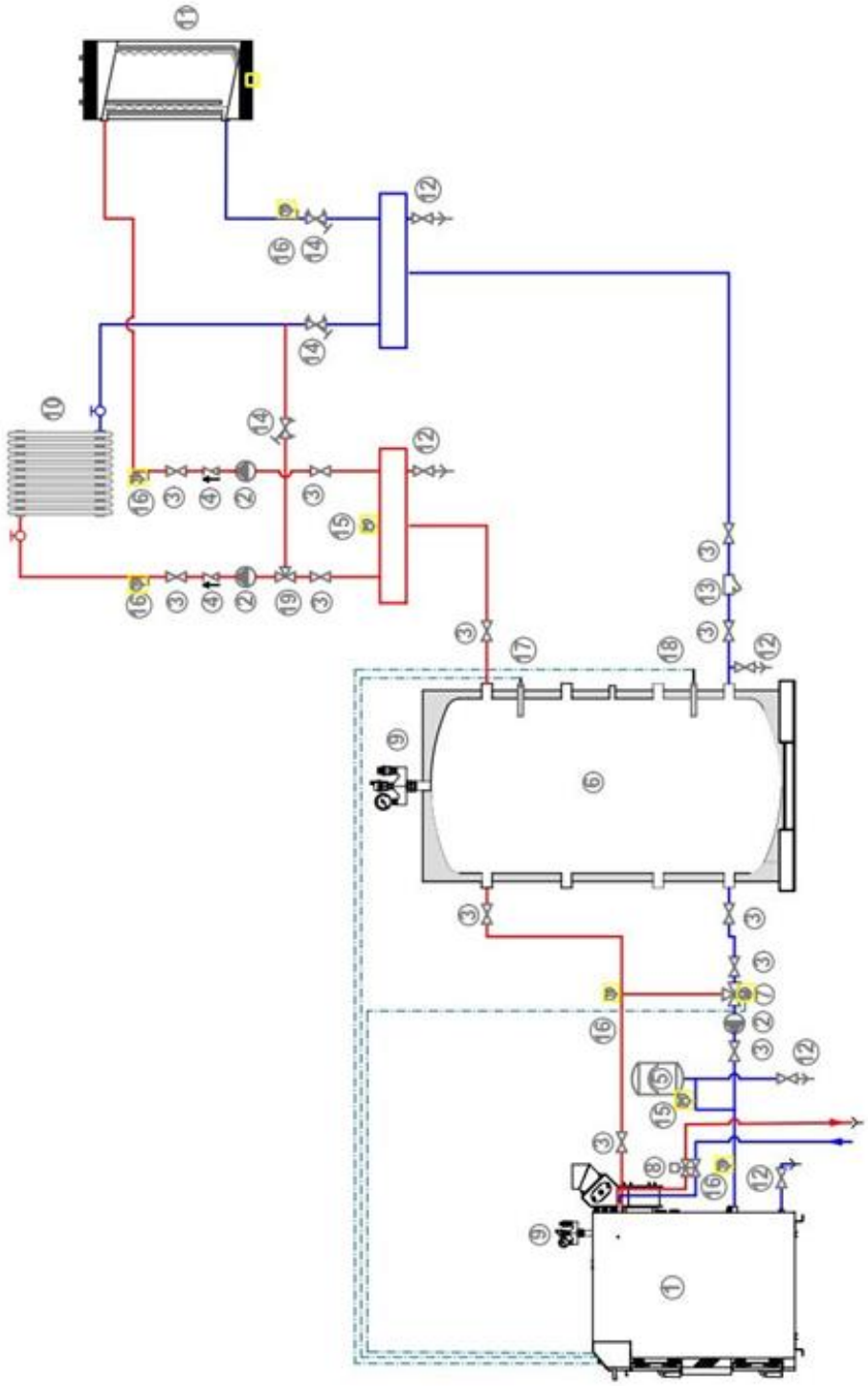
# 6. Hidraulična šema

***Prilikom montaže na hidrauličku instalaciju kotao mora biti obezbeđen na propisan način od prekoračenja maksimalne radne temperature i pritiska.***

***Za propisnu montažu odgovoran je instalater centralnog grejanja koji priključuje kotao na hidraulički sistem.***

***Radijator inženjering, kao proizvođač kotla, ne preuzima nikakvu odgovornost za štete prouzrokovane lošim instaliranjem kotla.***

***Ukoliko instalacija nije urađena po propisima odn.ne sadrži elemente prikazane po preporukama firme "Radijator Inženjering DOO", GARANCIJA SE NEĆE UVAŽITI.***



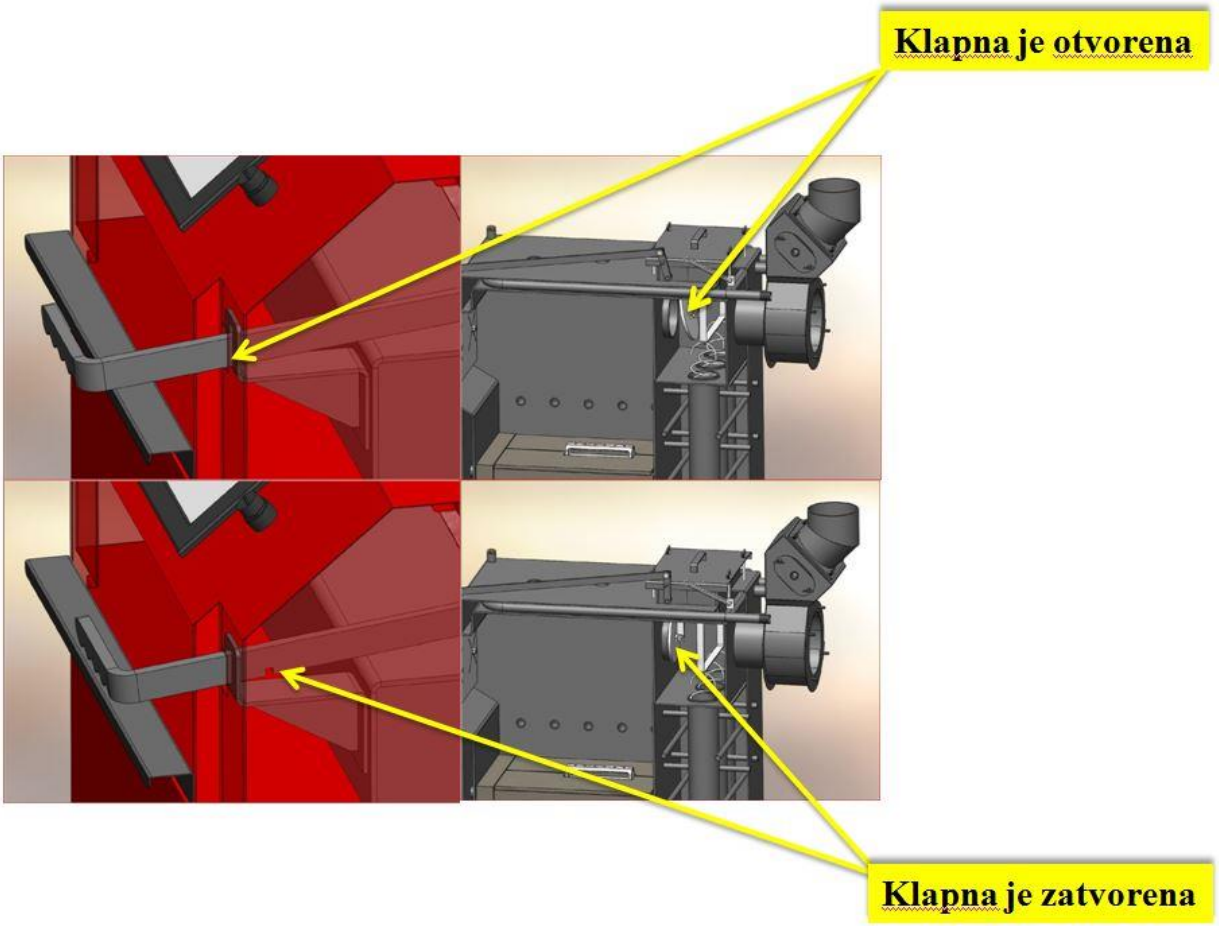
**Legenda:**1. Pirolitički kotao PK18; 2. Cirkulaciona pumpa; 3. Ventil; 4. Nepovratni ventil; 5. Ekspanziona posuda; 6. Akumulacija; 7. Trokraki mešni ventil sa elektro motorom; 8. Ventil za termičko osiguranje; 9. Sigurnosna grupa (ventil sigurnosti+manometar+odzračni ventil), 10. Izmenjivač; 11. Bojler za sanitarnu vodu; 12. Ventil za punjenje i pražnjenje; 13. Hvatač nečistoće; 14. Regulacioni ventil; 15. Manometar, 16. Termomanometar; 17. Senzor temperature akumulacijhe u gornjoj zoni; 18. Senzor temperature akumulacije u donjoj zoni; 19. Trokraki mešni ventil.

*Slika 14. Hidraulička šema sa akumulatorom i bojlerom za sanitarnu vodu*

# 7. Start rada kotla i održavanje

## 7.1. Start rada kotla i loženje

- Unutar kotla postoji klapna za usmerivanje dimnih gasova u dva režima „radni'' i položaj za „potpalu“. Ovom klapnom se rukuje pomoću ručice na prednjoj strani kotla. Pomeriti ručicu u smeru ka Vama i zabravite je pomoću zareza na istoj. Tada je klapna u položaju za potpalu. ***(Slika 15)***

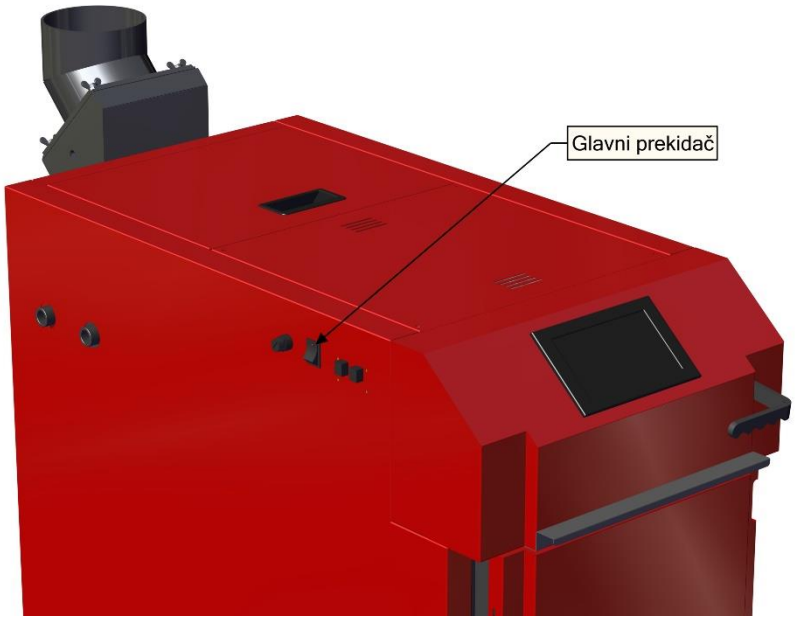



*Slika 15. Položaji klapne i ručice za klapnu u režimu "radni" i "potpala"*

- Ako je kotao prethodno ložen potrebno je odstraniti pepeo iz ložišta. Na opeku poređati sitne grančice i ostatke drveta, a preko toga staviti zgužvani papir i preko njega staviti još sitnih grančica do visine otvora za primarni vazduh koji se nalaze na bočnim stranama ložišta. Preko toga složiti cepanice drveta po dužini. Slagati ih do polovine ukupne visine ložišta***. (Slika 16)***

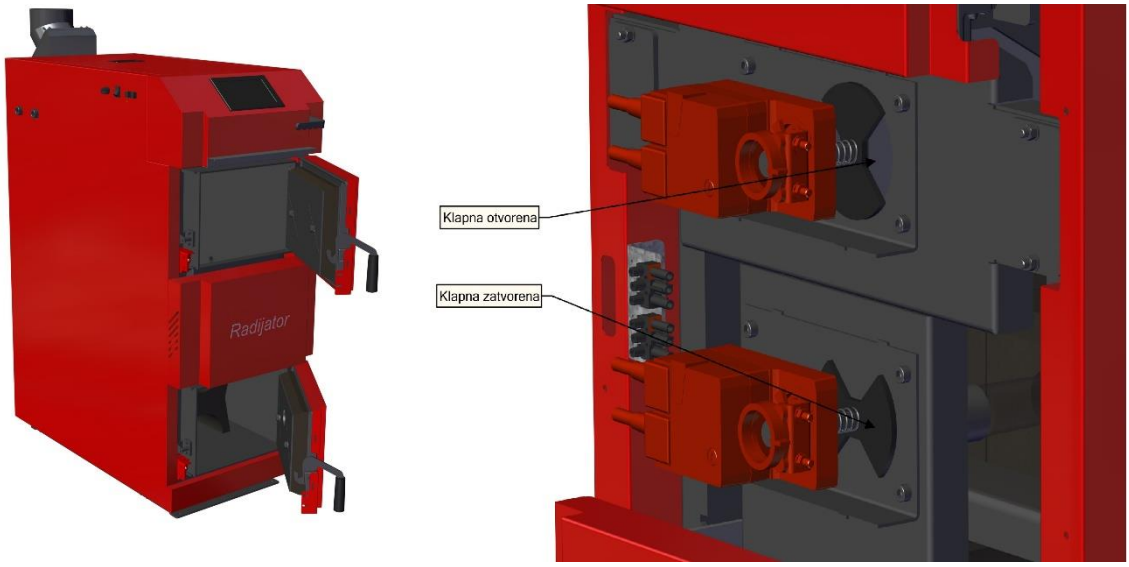
*Slika 16. Drva u kotlu*

- Pritisnuti taster za uključivanje automatike ***(Slika 17).*** Tada bi se na displeju moglo očitati da je proces potpale u toku i može trajati najduže 30minuta. U ovim trenucima ventilator radi sa maksimalnom snagom. Ukoliko ne uspe potpala u ovom periodu kotao prelazi u gašenje.




*Slika 17. Glavni prekidač*

- Pre same potpale kotla, potrebno je da se donja vrata kotla blago otvore. Takođe je bitno da klapna za primarni vazduh bude otvorena, dok je klapna sekundarnog vazduha zatvorena. ***(Slika 18)*** Ovo možete proveriti skidanjem maske koja se nalazi između gornjih i donjih vrata kotla. Maska se skida jednostavno tako što se blago podigne u smeru na gore i nakon toga se pomera u smeru ka Vama.




*Slika 18. Gornja i donja vrata otvorena, i klapna za primarni vazduh otvorena*

- Nakon toga je moguće potpaliti kotao.
- Kada se formira plamen u ložištu potrebno je gornja vrata zatvoriti, a donja vrata još uvek ostaju blago otvorena, koko bi plamen mogao da uhvati što veću količinu goriva.
- Kada sonda za temperaturu dimnih gasova registruje temperaturu koja je potrebna da kotao pređe u radni režim (gorenje), potrebno je zatvoriti donja vrata. Donja vrata se više ne otvaraju tokom trajanja celog procesa gorenja. Donja vrata se otvaraju samo kada se završi proces gorenja, tj. kada je potrebno kotao očistiti.
- Potrebno je klapnu dimnjače pomeriti iz položaja zabravljenja tj. ručica se pomera u smeru ka dimnjači i tada plamen kreće u smeru na dole kroz promajni prorez i ostvaruje se proces pirolize.
- Nakon prvog nalaganja (kotao je još uvek u fazi gorenja) pristupiti ponovnom punjenju ložišta gorivom. Tada je potrebno klapnu dimnjače opet povući ka sebi i zabraviti je, na taj način smo otovorili dimnjaču i plamen ide direktno u nju. Gornja vrata otvoriti tako da ih je potrebno prvo zadržati u blago otvorenom položaju i nakon nekoliko sekundi pristupiti ponovnom punjenju. Ložište je potrebno brzo napuniti kako bi smo izbegli da temperature dimnih gasova budu previsoke. Kada se ponovo napuni ložište gornja vrata je potrebno zatvoriti i odmah nakon toga možemo klapnu dimnjače iz zabravljenog položaja pomeriti u zatvoren položaj. Nakon toga proces pirolize se obavlja neometano.

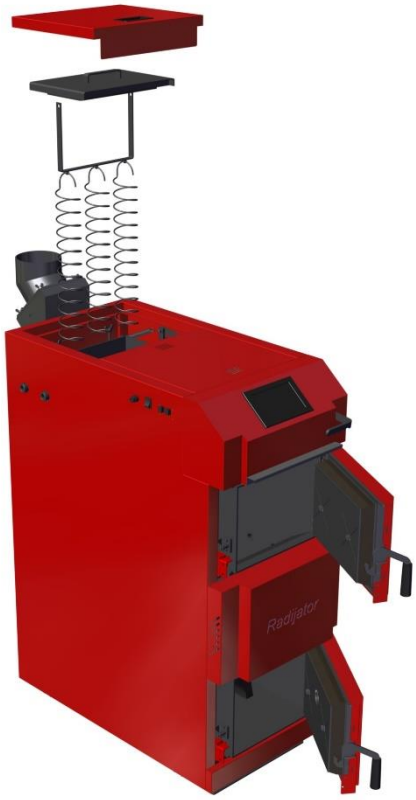
## 7.2. Održavanje i čišćenje kotla

Kotao PK18 zahteva svakodnevno i periodično čišćenje.

- Svakodnevno čišćenje se odnosi na čišćenje gornje komore za sagorevanje, kao i donje komore za sagorevanje.
- Prilikom korišćenja čvrstog goriva u kotlu se nataloži, relativno brzo, sloj čađi i katrana. Zato se preporučuje svakodnevno čišćenje pepela i ložišta. Za čišćenje i održavanje kotla koristiti pribor koji se dobija uz kotao **(*Slika 19*)**. Lopaticom ili strugačem odstraniti sasušene i zakorele naslage koje se ljušte (pepeo, ugalj i katran) sa zidova i iz svih uglova ložišta.

*Slika 19. Dodatni pribor za čišćenje kotla*

- Takođe je potrebno očistiti otvore za primarni vazduh.
- Takođe je potrebno otvoriti poklopac otvora za čišćenje i demontažu turbulatora i potrebno je izvaditi turbulatore i očistiti cevi turbulatora. ***(Slika 20)*** Posle čišćenja istih, potrebno je vratiti poklopac i dobro ga pritegnuti tako da se obezbedi dihtovanje.



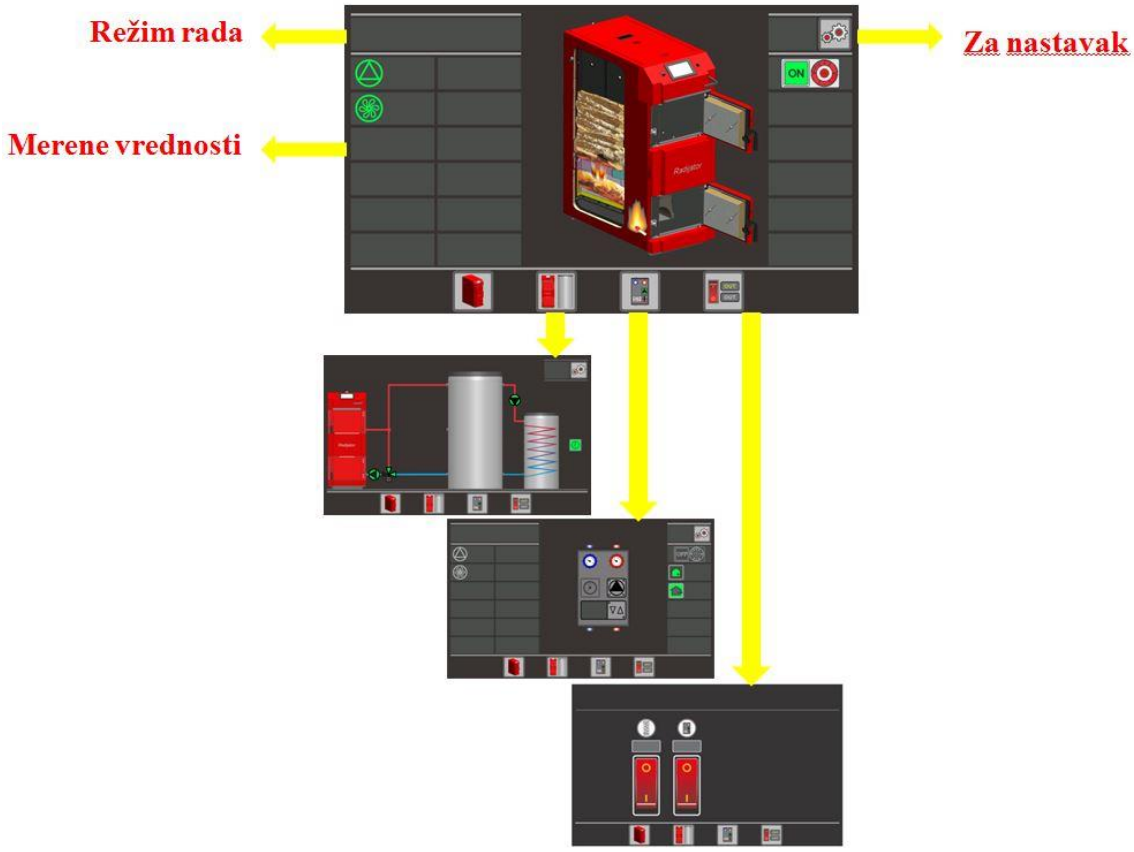

*Slika 20. Otvorena donja i gornja vrata i izvađeni turbulatori*

- Kod čišćenja moramo dovesti veću količinu svežeg vazduha u kotlarnicu da nebi došlo do gušenja ložača.
- Kada se kotao detaljno očisti treba jedan sat ložiti jače da temperatura u kotlu dostigne 85˚C, što doprinosi sagorevanju čađi i štetnih materija u ložištu kotla. Na taj način kotao će imati bolji stepen iskorišćenja.
- Preporučujemo redovni nadzor dimničara.
- Po prestanku grejne sezone kotao treba detaljno očistiti, a zatim zatvoriti sva vrata uključujući i klapne za prodor primarnog i sekundarnog vazduha i klapne ložišta. Na ovaj način sprečava se da i u letnjem periodu dimnjak ne pravi strujanje vazduha kroz kotao, odn. eleminiše se mogućnost podhlađivanja zidova ložišta i cevi turbulatora, i efekat rošenja. Eventualno rošenje kotla i u letnjem periodu negativno utiče na vek trajanja.

**Male pukotine na površinama vatrostalnog betona su potpuno normalen i ne utiču na funkciju i životni vek delova. Crne sjajne naslage na unutrašnjim zidovima komore za punjenje su potpuno normalne i ne moraju da se otklanjaju.**

## 7.3. Kratko upustvo za automatiku

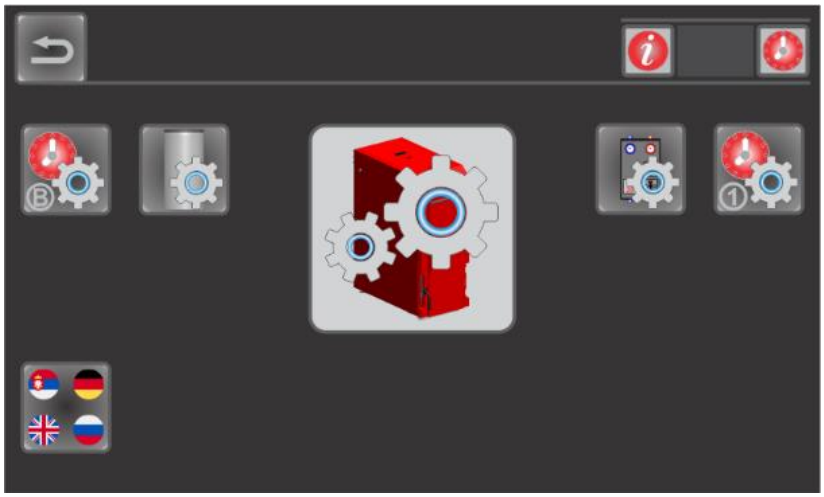
### 7.3.1. Osnovni izgled displeja




### 7.3.2. Za nastavak

Ako želite da pređete na sledeću postavku, pritisnite u gornjem desnom uglu.


U tom slučaju prikaz na ekranu je:



Za povratak na predhodnu postavku na ekranu pritisnuti u gornjem levom uglu ekrana.

### 7.3.3. Promena datuma

Ako želite da promenite vreme, pritisnite ikonicu u gornjem desnom uglu ekrana. Na ekranu je prikazano sledeće:


Sa pritiskom na željeni dan, menjate dan u nedelji.

Da biste podesili vreme, prvo pritisnite sat i unesite vrednost pomoću tastera. Obavezna je potvrda uz pomoć ENTER pošto ste uneli željenu vrednost. Nakon toga isto postupak ponoviti i za minute.

Po završetku pritisnuti ikonicu .

### 7.3.4. Sanitarna voda

Da biste podesili željenu temperaturu sanitarne vode, pritisnuti ikonicu u glavnom meniju.


Pomoću tastarature unosite željenu vrednost (npr. 60°C, kao na slici). Obavezna je potvrda uz pomoć ENTER.

Po završetku obavezno pritisnuti ikonicu .

### 7.3.5. Promena jezika

Za promenu jezika pritisnuti ikonicu .

Nakon izbora jezika, pritisnuti ikonicu .

### 7.3.6. Promena osnovnih parametara za grejanje

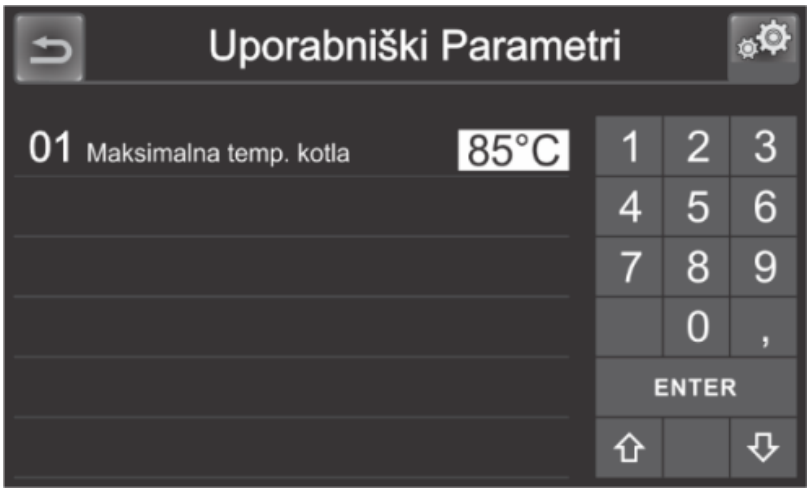
Za promenu osnovnih parametara za grejanje izaberite ikonicu .


Vrednosti parametara menjate uz pomoć tastature. Obavezna je potvrda uz ENTER.

Na kraju obavezno pritisnuti ikonicu , kako bi podešavanja ostala sačuvana.

### 7.3.7. Menjanje osnovnih paramatera rada kotla

Za promenu osnovnih parametara kotla, kao što je maksimalna temperatura vode u kotlu, pritisnite ikonicu .




*Slika je simbolična*

Prikazani parametar menjate tako što pritisnite vrednost parametra (u ovom slučaju 85°C), a potom pomoću tastature unesete novu vrednost i potvrdite je pritiskom na ENTER.

Pritisnuti ikonicu kako bi promena bila zapamćena i da biste se vratili na predhodno.

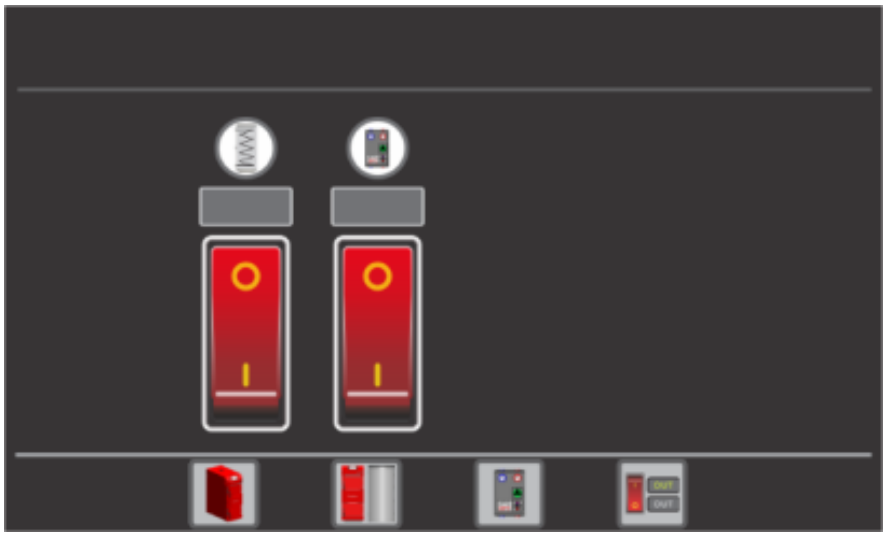
### 7.3.8. Osnovne informacije o kotlu

Za osnovne informacije o kotlu pritisnuti ikonicu . Na ekranu će Vam se pojaviti osnovne informacije kao što su: ukupno vreme rada kotla, vreme rada ventilatora, ukupno vreme rada pumpe, broj prekida STB-a, da li je kotao bio pregrejan i verzija EcoReg-a.


Za povratak na glavni meni pritisnuti .

### 7.3.9. Ručno upravljanje

Postoji mogućnost da ručno uključite odnosno isključite sistemske delove (akumulacija, krugovi grejanja) na Vašem sistemu. Jednostvno pritisnite prekič sa slike u nastavku.



# 9. Garancija

1. **Radijator inženjering pokriva garancijski period od 60 MESECI samo ako su ispunjeni sledeći uslovi garancije:**

   1.1. Kotao mora biti priključen po navedenim hidrauličkim šemama iz tehničkog uputstva,naročito obratiti pažnju na sigurnosne ventile,termičko osiguranje oticanjem, mešajući ventil za zaštitu hladnog kraja kotla odnosno protiv kondenzacije, opseg radnog pritiska kotla, opseg radne temperature kotla,uslove u kotlarnici itd**. ( videti tačku 3 i 6.)**

   1.2. Kotao mora biti priključen na dimnjak propisanog poprečnog preseka, karakteristika izolacije i visine. **(videti tačku 3.4)**

   1.3. Dimovod od kotla do dimnjaka mora mora biti izveden po tehničkom uputstvu.

   1.4. Korisnik mora da se pridržava navedenih uputstava o korišćenju i održavanju. **(videti tačku 7.1 i 7.2)**

2. **Garancijska izjava**

Izjavljujemo:

- da proizvod ima propisana i deklarisana kvalitetna svojstva.
  Obavezujemo se, da ćemo na zahtev kupca ako pravovremeno u garancijskom roku podnese zahtev za popravku, o svakom trošku izvršiti sve popravke kvarova, tako da će proizvod raditi u skladu sa deklarisanim svojstvima,
- da će proizvod u garancijskom roku raditi besprekorno ako se budu poštovala uputstva za upotrebu, rad i montažu,
- da ćemo u garancijskom roku biti spremni da otklonimo sve kvarove na proizvodu i držati na zalihama sve potrebne rezervne delove,
- **garancijski rok počinje od DANA KUPOVINE I TRAJE 60 MESECI ILI 72MESECA OD DATUMA PROIZVODNJE (datum proizvodnje nalazi se na nalepnici sa zadnje strane kotla)**
- **garancija važi ako je garantni list overen od strane prodavca i ako je upisan datum kupovine i priložen račun.**

3. **Garancijski period od godinu dana važi za sledeće delove**

- opeka u ložištu,
- automatika kotla EcoReg 1750 i sonde koje se standardno isporučuju uz automatiku (sonda za temperaturu dimnih gasova, sonda za temperaturu vode u kotlu, sonda za temperaturu vode u povratnom vodu, senzor za temperaturu u gornjoj zoni akumulacije, senzor za temperaturu u donjoj zoni akumulacije, sanitarna voda, senzor spoljašnje temperature, senzor za temp.mešnog kruga grejanja, Lambda sonda).

4. **Garancijski period od dve godine važi za sledeće delove:**

    - Belimo motori za regulaciju primarnog i sekundarnog vazduha.

5. **Garancijski rok ne važi:**

- kod kvarova koje je načinio kupac zbog nestručnog rukovanja proizvodom,
- kod mehaničkih kvarova načinjenih prilikom transporta i prilikom korišćenja(čvrsti predmeti),
- ako je proizvod instaliran nestručno, suprotno važećim propisima iz tog područija,
- ako je kupac koristio proizvod iznad deklarisanih svojstava i u normalnim okolnostima,
- ukoliko se utvrdi da hidraulička šema nije urađena po preporukama firme „Radijator inženjering",
- ukoliko se utvrdi da kotao u toku korišćenja nije redovno održavan i čišćen,

6. **Garancijski rok prestaje da važi:**

- ako se ustanovi da je kvarove otklanjala neovlašćena osoba ili neovlašćeni servis,
- ako kod popravke nisu bili upotrebljeni i ugrađeni originalni delovi,
- kad ističe garancijski rok.

7. **Kod prijave kvarova obavezno je dati sledeće podatke:**

- naziv i tip proizvoda,
- datum kupovine,
- fabrički ili radionički broj kamina,
- kratak opis kvara, odnosno nedostatka,
- tačnu adresu i kontakt telefon, mejl.

# Contents:

# 1. Important warnings

## GENERAL WARNINGS

- After removal of the packaging, make sure that the delivery is complete, and in case of missing parts, contact the seller who has sold the boiler.
- The boiler must be used solely for the purpose intended by the manufacturer. The manufacturer excludes any responsibility for damages caused to persons, animals or objects in cases of improper installation, regulation, maintenance or improper use.
- In case of water leaking during filling of the system, close the water supply and inform the authorized service or authorized installer.
- This instruction is an integral part of the device and must be carefully kept and must **ALWAYS** accompany the boiler, also in the case when owner or user is changed or when the boiler is connected to another installation. In case of damage or loss of the instruction, ask the authorized seller for a new copy.

## IMPORTANT WARNINGS

We emphasize that the use of solid fuel boilers requires observance of safety measures as follows:

- Children and persons with limited abilities must not use the boiler without supervision.
- It is forbidden to use the boiler in installations with working temperature exceeding 110˚C and working pressure exceeding 3 bars.
- It is forbidden to use easily flammable fuels (alcohol, fuel oil) for faster ignition of wood.
- It is forbidden to store easily flammable materials near the boiler and near the stocking door. The ash must be stored in closed and non-flammable containers.
- It is forbidden to burn waste and materials the combustion of which causes flame or danger of explosion (e.g. plastic bags, sawdust, coal dust, mud etc.).
- Modification of safety elements is forbidden.
- It is forbidden to close the ventilation openings in the room in which the boiler is installed. Ventilation openings are necessary for proper combustion.
- It is forbidden to expose the boiler to the atmospheric conditions. The boiler itself is not foreseen for outdoor installation and does not contain a system against freezing.
- It is forbidden to shut down the boiler if the outside temperature can fall below ZERO (danger of freezing)
- Take care of the position of safety air cover (detailed explanation in chapter STARTING **OF THE BOILER**).

- Operating of the boiler installation is forbidden to physically and mentally disabled persons (including children), except when under supervision of guardians and people responsible for their behaviour.
- To prevent playing with the boiler, children must be under supervision of guardians.

### 1.1. Minimal distance from flammable materials

- Ensure appropriate distance from flammable materials; if necessary provide protection for such materials.
- Minimal distance from flammable materials is prescribed by law – please ask the competent persons involved in heating and chimney sweepers about the legal requirements.
- Minimal distance of the boiler and flue gas evacuation pipes from low and average flammable materials should be at least 100 mm.
- Minimal distance from easily flammable materials is 200 mm; same applies to materials the flammability of which is not known.

**Fire danger!**

- It is forbidden to store flammable materials and liquids near the boiler.

- It is obligatory to inform the users about the necessary minimal distance between flammable materials and the boiler.

| Flammability of building materials | |
|---|---|
| A …<br>nonflammable | asbestos, stone, building stone, ceramic wall tiles, terra-cotta, mortar, cement glaze (without organic additives) |
| B …<br>which are not easily flammable | gypsum cardboard plates, glass fibers, plates made of AKUMIN, IZOMIN, RAJOLIT, LIGNOS, VELOKS and HERAKLIT |
| C1…<br>poorly combustible | beech and oak wood, composite wood, felt, plates made of HOBREKS, VERZALIT, UMAKART |
| C2…<br>with average combustibility | pine, yew and fir wood, composite material |
| C3…<br>easily flammable | asphalt, cardboard, cellulose materials, chipboard, cork, polyurethane, polystyrene, floor fibers |

# 2. “PK” series boiler description

**PK 18** series boiler was developed by **RADIJATOR INŽENJERING DOO** with the aim to offer a boiler that is, according to its mechanical and thermal properties, intended specifically for pyrolytic wood burning process. Under the pyrolysis principle, the fuel thoroughly burns down in a very ecological wood gasification process which significantly increases the degree of utilization and reduces the level of harmful emissions in the environment compared to traditional combustion principles.

The combustion takes place in a two-part firebox in several stages. The upper and lower chamber are mutually separated by a “draft slot” made of fire-resistant ceramics.

The upper chamber is used to stack wood. Wood logs are properly stacked in the chamber, where the minimal length of the logs has to be bigger than the “***draft slot”***, but not more than 50 cm. For the optimal results and maximal degree of utilization, the recommended moisture level in the wood is around 15%-20%. The pyrolysis process, i.e. “gasification” of the wood takes place in the upper chamber.

The main pyrolysis process takes place in the lower chamber, which is additionally protected by a layer of fire-resistant ceramics.

***Principle of work of the boiler (Figure 21):*** After the fire is fired up in the boiler (firebox flap is closed, while it was initially open, as was the primary flap), in the beginning the wood goes through an additional drying process. When the flame forms, the secondary air flap opens. The wood gasification process starts in the upper chamber, thus releasing hydrocarbon gases which, due to the draft in the boiler, want to penetrate the lower chamber through the draft slot. A part of these gases combust in the upper chamber, while the remaining gases, together with the less combustible particles, combust in the lower chamber where the temperature reaches around 1100°C.

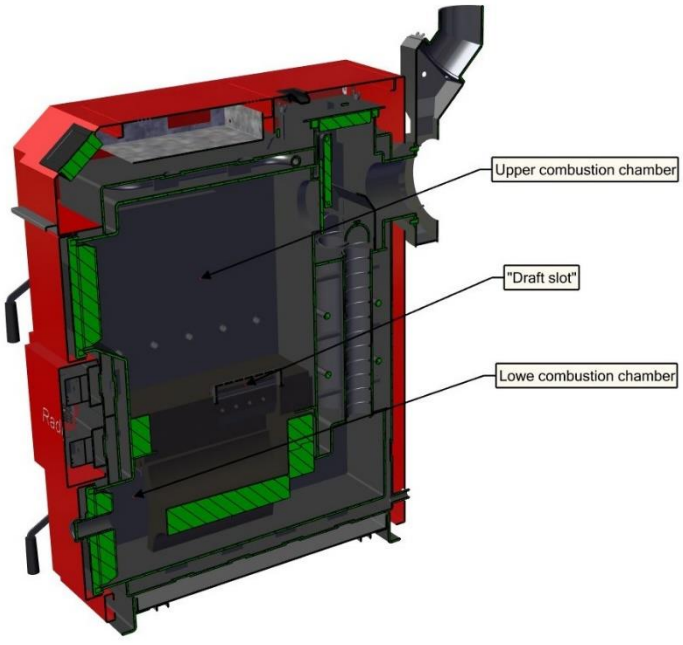



*Figure 21. Upper and lower combustion chamber and the draft slot*

In this way, an insignificant portion of the harmful non-combusted particles reaches the uptake, thus reducing the level of harmful emissions which complies with all the standards and norms prescribed by the European Union. Such combustion achieves the highest possible level of utilization and the boiler has higher efficiency.

The temperature of gases exiting this type of boiler is lower than the temperature exiting the standard solid fuel boilers. This can lead to the occurrence of condensate if the boiler is not properly used, and therefore make sure to carefully read the section ***STARTING AND CLEANING OF THE BOILER;*** it is also recommended to install a mixing valve on the boiler return line.

For the optimal utilization of energy and comfort during use (number of fuelling is reduced to the absolute minimum, once to twice a day), the additional installation of heat storage is recommended. For the 1kW boiler, it is recommended to use 55l heat storage, so that, together with our PK 18, the ideal accumulation amounts to 1000l.

The use of specified fuels implies automatic control of the main operating parameters. The work is regulated using the automation placed in the upper part of the boiler, which is used to regulate the work of the motors that operate flaps for primary and secondary air ***(Figure 22).***

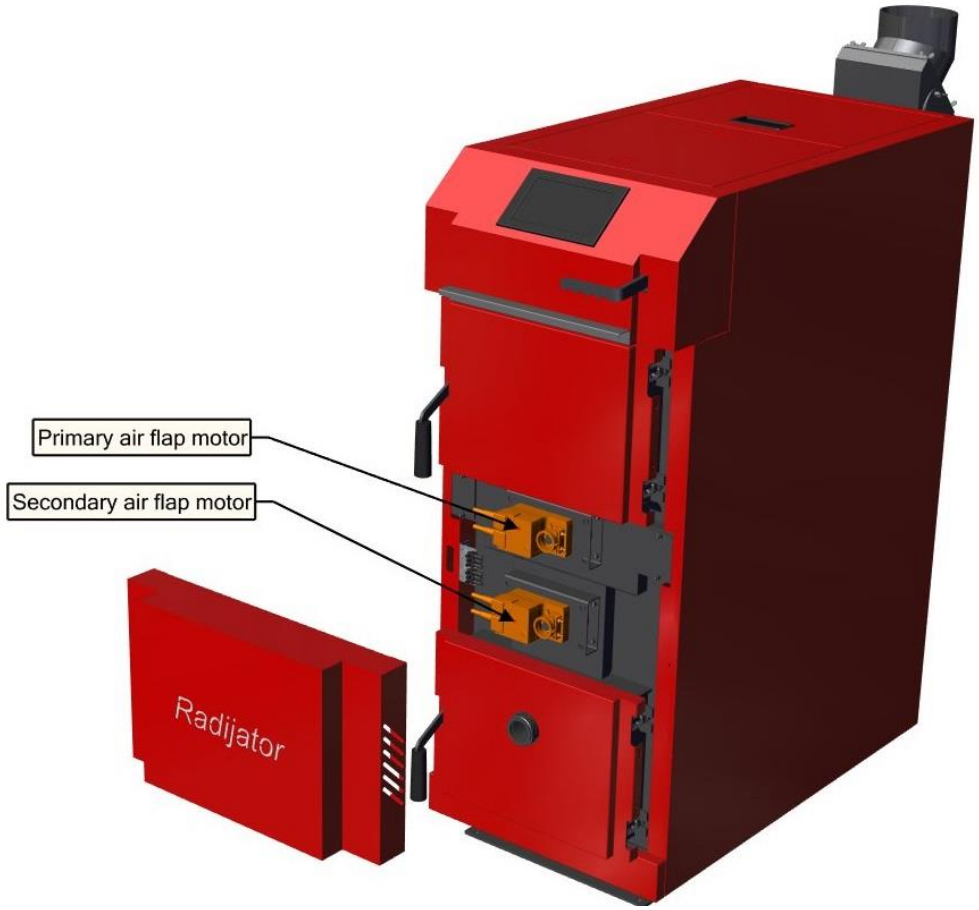



*Figure 22. Motors for primary and secondary air flaps*

**The rated power of the pyrolytic PK 18 boiler is 18kW.**

According to the external design, dimensions of the firebox, firing openings and cleaning properties, PK 18 has kept the good features of the previous models for which RADIJATOR INŽENJERING is recognizable in the market.

The large doors and firebox on the boiler allow firing of large pieces of wood, but also enable easy cleaning and maintenance. The duration of one fuelling is at least 4h at rated boiler power. The boiler has the ability to maintain the ember for 12 h, so that new firing up is not necessary if your want to continue fuelling.

The water part of the boiler, and its mode of heat exchange between flue gases and water, is adjusted to wood. Due to the use of fans, i.e. forced draft, the flue gas route is longer than in standard boilers. For these reasons, it is possible to use flue gas routers, so-called turbulators, which additionally increase the efficiency of the boiler.

The efficiency of the boiler exceeds 90%. In normal mode, the flue gas temperature at the exit is around 160 °C, while in maximal modes it is below 210 °C. These values may be read on the display at any time. During operation, soot and ash deposit in the exchanger part of the boiler, which results in significant decrease of heat exchange and the increase of flue gas temperature. If the boiler is not cleaned over a longer period of time, the flue gas temperature may become so high that the boiler enters a modular mode of work. All parts of the water portion of the boiler are produced of seamless pipes of **ST 35.4** quality and boiler sheets with thickness of 4-5 mm, depending on the boiler power. Sheets correspond to the quality prescribed by **1.0425 EU** standard i.e. **P265GH EUII** standard**.**

# 3. Installation

## 3.1. General warnings

**To work properly, the boiler must be properly placed!**

The boiler must be installed in such way that the access is possible from all sides for the purpose of cleaning and maintenance (continued in **item 3.3**)

For the normal operation of the boiler, fresh air has to be supplied in the boiler room (**item 3.3**) and the chimney has to have the prescribed characteristics and has to be made of chamotte chimney pipes with prescribed diameter (**item 3.4**).

 **Maximum working pressure of the boiler is 3 bar, minimum pressure is 1 bar, and maximum working temperature of the boiler is 110℃.**

 **Solid fuel boiler shall be installed according to current norms and law regulations. Every change on mechanical structure will be considered as breach of warranty conditions and will lead to its violation.**

 **During the connecting to the hydraulic installations, the boiler has to be adequately secured so that the maximal temperature and pressure are not exceeded.**

 **Central heating fitter is responsible for adequate installation and connecting of the boiler to the hydraulic system.**

 **Radijator Inženjering doo, as the manufacturer of the boiler, does not take any responsibility for the damage caused by inadequate installation of the boiler.**

Basic requirements which have to be respected during installation are:

- The boiler can be connected to the open system for central heating, but also to the closed system for central heating. When connecting to the closed system, it is recommended to install the valve for thermal protection, which is also prescribed by corresponding laws of every state in which the boiled is installed.
- The boiler must be installed at the safe distance from easily flammable materials.
- The connection to the chimney is also done according to the binding regulations, as well as according to the manufacturer's recommendations which can be found in the text below.

## 3.2. Safety measures and devices for "PK" series boiler

For safe operation of "PK" series boiler, it is necessary to install following elements and to maintain them in proper order:

- **Pressure safety valve, air bleeding valve and pressure gauge;**
- **Flow out valve for thermal safety.**

Pressure safety valve (*figure 23*), air bleeding valve (*figure 24*) and pressure gauge (*figure 25*):

*Figure 23. Safety valve*

*Figure 24. Air bleeding valve*

*Figure 25. Pressure gauge*

- Pressure safety valve must have a nominal diameter of 1/2 inch and calibrated on maximum 3 bar. This safety element which is in the group of pressure limiting instruments must be made in such way to withstand for short time higher temperatures and overpressure as well as certain content of glycol in the heating fluid. Usually at the same place the air bleeding valve (***figure 24***) and pressure gauge (***figure 25***) are connected in such a way that these three elements together form the safety group and are mounted using "T" connections. This safety element must be recalibrated from time to time, which should be shown in valid documents in possession of the investor i.e. the user of the boiler.

- The safety valve must be installed at the highest point on the boiler and directly on the boiler, without any piping or any other elements in between. Special connection is provided for this purpose (***see figure 26***). Any reduction of the diameter of this connection is strictly forbidden.

- Exhaust part of the safety valve must be made of the pipe with diameter at least the same as the nominal diameter of the exhaust part of the valve. During the installation, it is also permitted to use not more than one arch with the radius r > 3d.

- Safety valve must have the identification plate with following information:
  - the name of the manufacturer
  - mark of the safety valve type / year of testing

- nominal flow
- data on the calibrated thermal output of the safety valve
- the highest opening pressure i.e. 3 bar

- In prescribed periods of time it is necessary to check the proper operation and to perform recalibration by certified companies. These obligations will be done according to the law of the country in which the boiler is installed. It is obligatory to keep written document with data from last calibration of the safety valve.

- At least one more safety pressure valve needs to be installed on the return line.

Flow out valve for thermal safety (*Figure 26*)

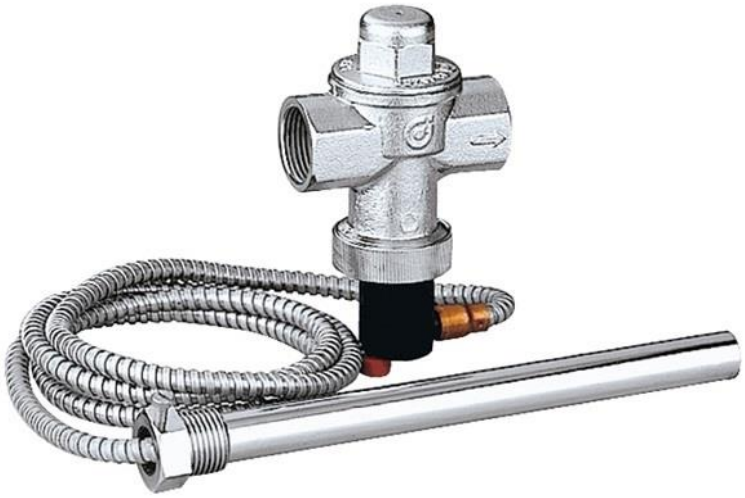


*Figure 26. Thermal safety valve*

This safety element also has the role to limit the temperature. In the following text it is marked by abbreviation VTO.

- In some extremely dangerous situations, the transformation of water to steam is such that safety pressure valves are not sufficient to provide for the safety of the hydraulic system. Due to this reason, the installation of the VTO is obligatory. Depending on legal regulations in countries in which the boiler is installed, VTO must be installed only for powers greater than prescribed or VTO must be installed for all powers.

- Place for installation is shown in the installation diagram for the boiler. Cold sanitary water is fed to the VTO. When the probe in VTO has the information that the temperature is over 95 degrees, VTO opens and the water passes through the copper spiral. After some time, the temperature of the water in the boiler returns to normal.

- One connection of the spiral is used for VTO and the other for letting out the water which has passed through the spiral. It does not matter which connection of the spiral

is for VTO and which for letting out the water. It is obligatory to observe the instructions for installation which the manufacturer of VTO has given.

- It is obligatory to check the functioning of the VTO in prescribed time intervals.

As already said, one end of the VTO is for installation on the heat exchanger of the boiler and the second for feeding of cold water under pressure. It is very important that the flow of such water is unobstructed also when there is no supply of electric power.

**If it is not possible to provide for the flow of cold sanitary water also when there is no supply of electric power, the boiler must be connected to an open system.**

**If the supply of sanitary water to the thermal safety valve is through an additional pump, the boiler must be connected to an open system.**

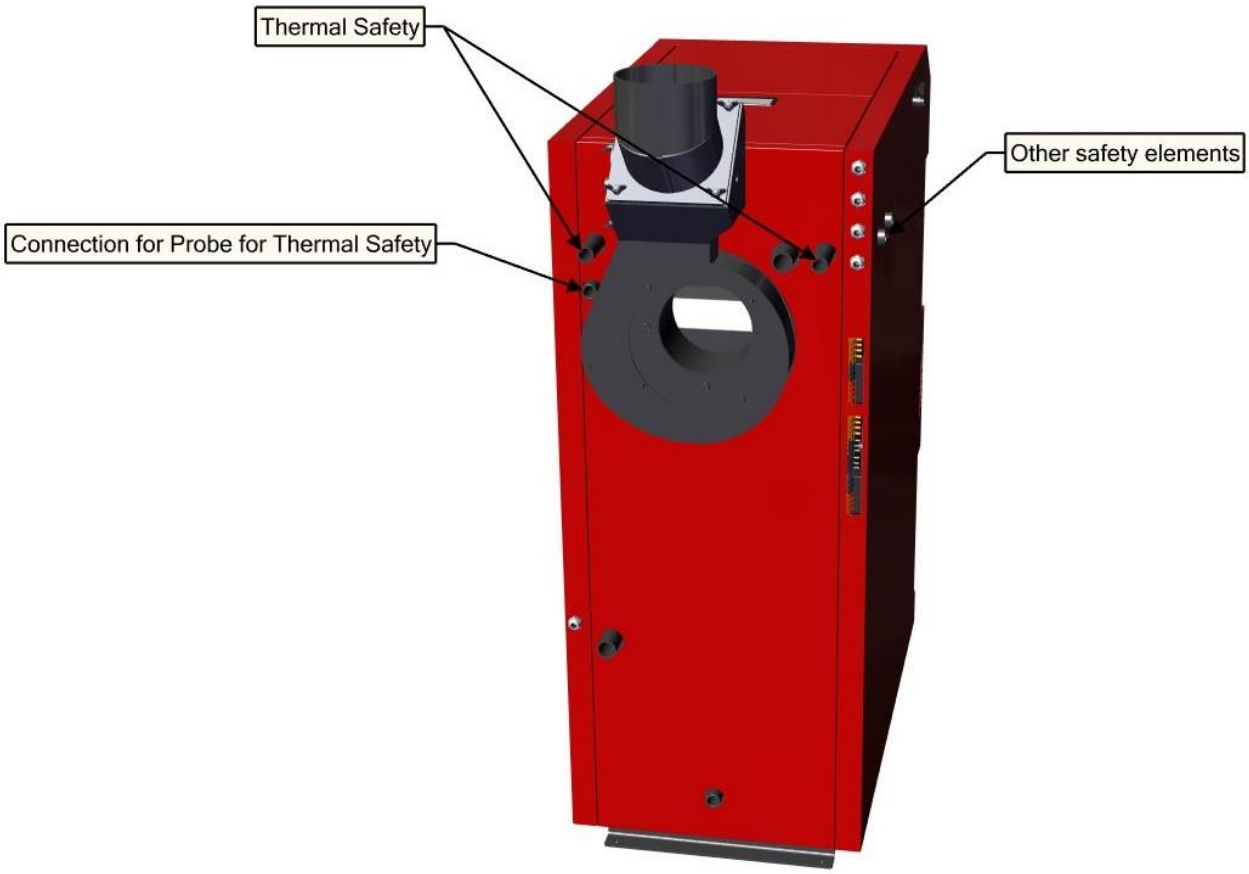



*Figure 27. Installation of safety elements*

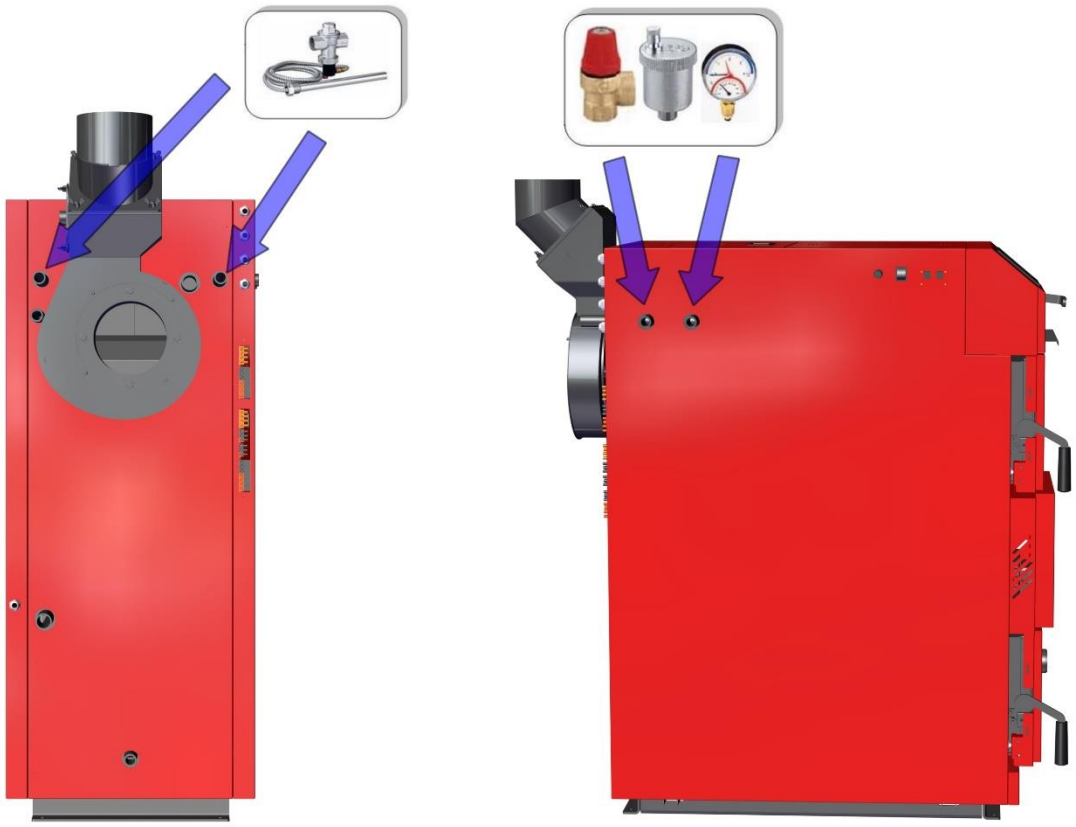


*Figure 28. Installation of safety elements*

## 3.3. Boiler room

**The boiler room must be protected against freezing!**

Foundation for boiler in the boiler room must be of non-flammable material. Recommended distances on all four sides of the boiler from the walls of boiler room or some other rigid bodies (accumulating boiler etc.) are shown in **figure 29**. These distances enable safe access during stoking, adequate space for cleaning and unobstructed access to the valve for filing and emptying. **The boiler room must have adequate openings for ventilation for the fresh air and for the evacuation of the spent air.**

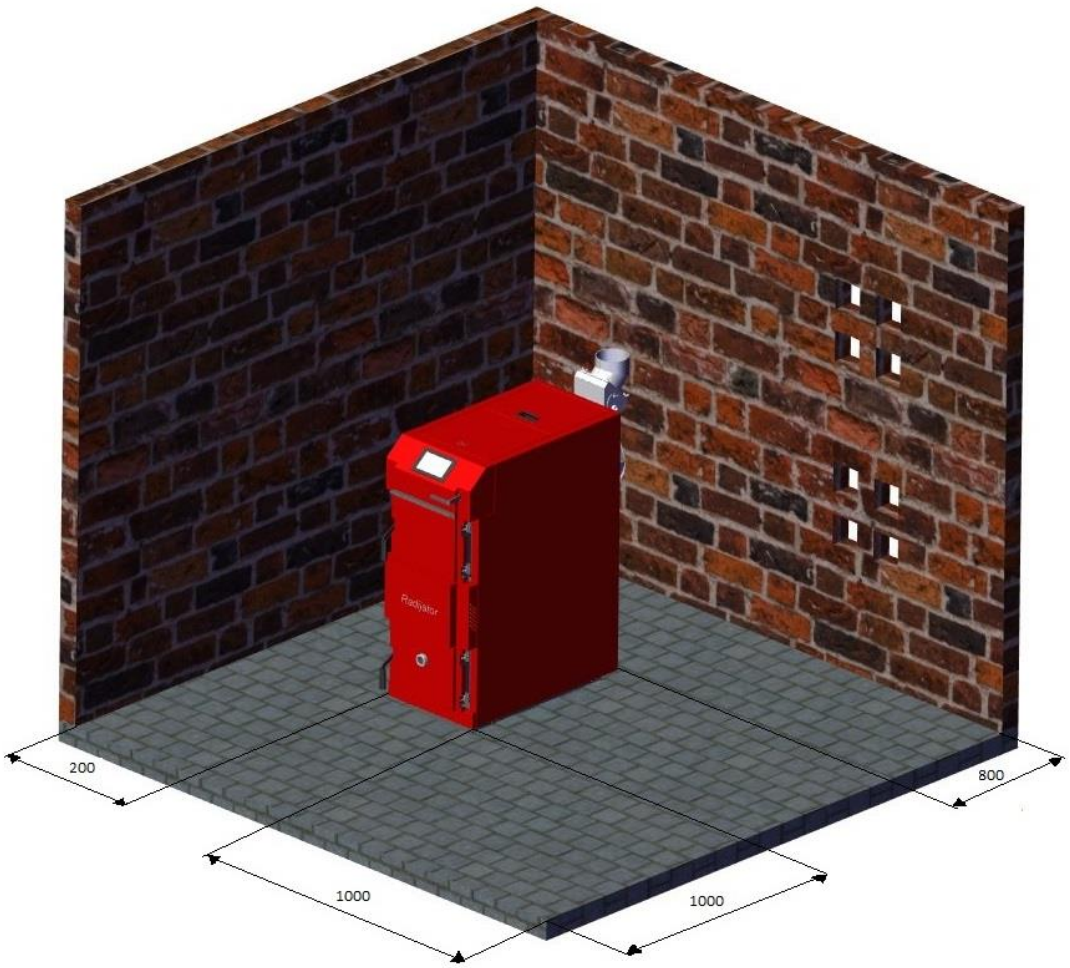



*Figure 29. Positioning of the boiler in the boiler room*

The total area of these openings is minimum 150 cm² for output up to 50 kW and for output above 50 kW the opening must be greater by additional 2 cm² per kilowatt.

$$A=150cm^2+\frac{2cm^2}{kW}\times(\sum Q_n-50kW)$$ $\sum Q_n$ = possible outputs over 50kW.

Lack of sufficient ventilation in the boiler room can cause numerous problems in boiler operation. The main problem is impossibility to attain high temperatures of outgoing water i.e. not attaining the maximum power which leads to the condensation of the water inside the boiler.

- Take into account the necessary minimum space needed for access to the safety elements and for performing the cleaning operation.
- It is forbidden to expose the boiler to bad weather conditions. The boiler itself is not intended for outdoor installation and does not include a system against freezing.
- It is forbidden to close the ventilation openings in the room in which the boiler is installed. The ventilation openings are necessary for proper combustion.

## 3.4. Chimney connection

The optimal placing of the boiler on the uptake is such that the strait line which connects the centre of exit of flue gases from the boiler and the centre of connection to the chimney is gently raising (up to 3%) (**Figure 30**).

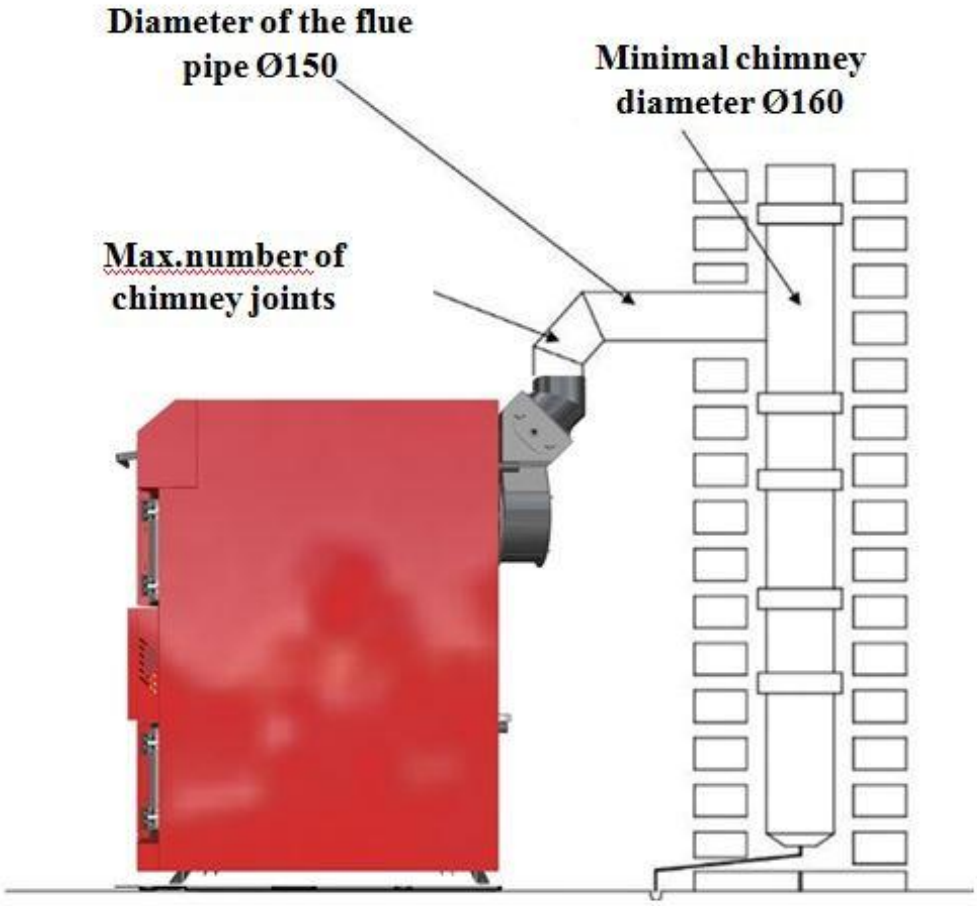



*Figure 30. Connecting of the boiler to the chimney*

Arches should be avoided if possible; if not, the maximum number of arches should be 2. It is preferable to insulate the smoke channel from the boiler to the chimney, especially if there are arches and longer parts.

The chimney itself should be made of ceramics pipes, around the pipes 3 – 5 cm thick insulation shall be placed and the last outside layer shall be made of brick or special chimney elements.

If the chimney is not made of ceramics but of bricks, the area of unobstructed section of such chimney shall be 30% greater than the area of the chimney made of ceramics. The minimum height of the chimney is 7m.

The chimney must have a small door for cleaning which must seal well. Chimney exit on the roof must be made in accordance with the applicable regulations. There are two different cases: if the angle of the roof is less than 12 degrees and if the angle of the roof is greater than 12 degrees. For the angle less than 12 degrees, the height above roof is 1 m and for the angle which is greater than 12 degrees, the drawing below should be consulted.

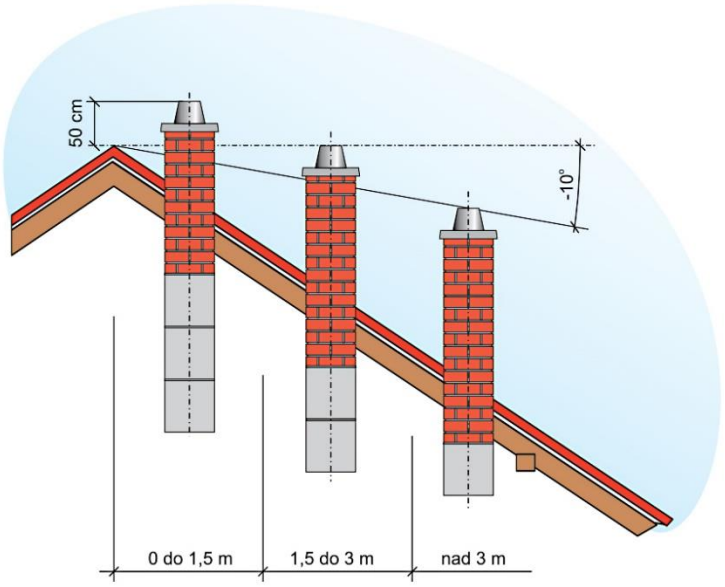



*Figure 31. Prescribed dimensions of chimney*

If you are of opinion that the chimney is too strong and that too much cold air passes through the boiler, at the exit of the boiler there is a flap which can be used to reduce the flow of the exhaust gases. The chimney should be regularly cleaned or at least once a year.

***If the chimney is not made with the proper height, cross-section or if it is not cleaned, complications in boiler operation are possible. First of all, high temperature operation is not possible, i.e. there is no maximum operating power, and the consequence is the occurrence of condensation which affects the working life of the boiler.***

***Weak chimney is the main reason why during the ignition of the boiler the smoke appears on upper or lower door, especially when the number of revolution of the fan is higher.***

# 4. Cross-section of the “PK” boiler with the description of elements

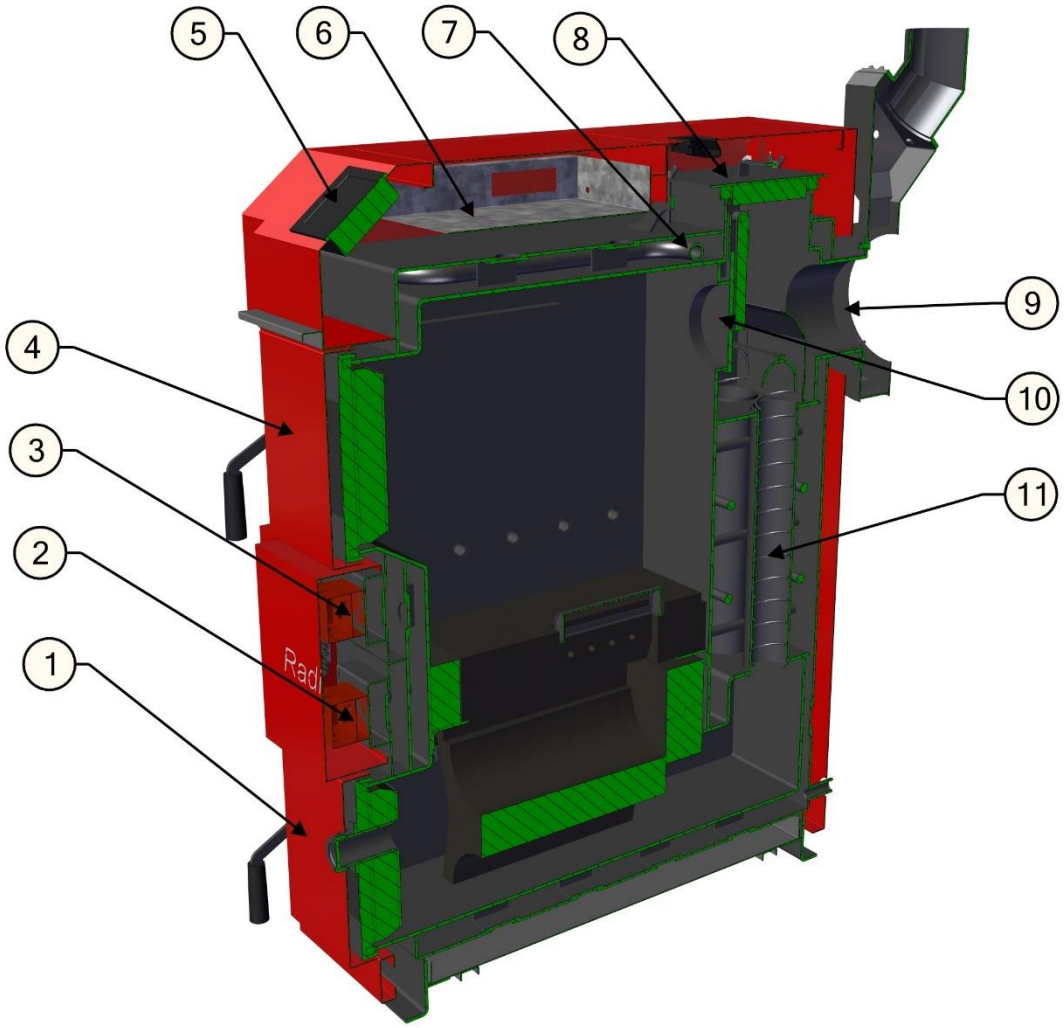



*Figure 32. Cross-section of the PK 18 series boiler*

*1. Lower door,*
*2. Upper door,*
*3. Primary air flap motor,*
*4. Secondary air flap motor,*
*5. Automation,*
*6. Automation support,*
*7. Thermal safety,*
*8. Cover of the turbulator cleaning and disassembly opening,*
*9. Flue outlet,*
*10. Firebox flap,*
*11. Turbulators.*

# 5. Technical data table

| BOILER TYPE | | *PK 18* |
|---|---|---|
| **CE mark** | | **CE** |
| **Boiler class according to EN 303-5:2012** | | **V** |
| **Working pressure** | bar | **3** |
| **Test pressure** | bar | **4.5** |
| **Firebox volume** | L | **83** |
| **Volume of water in the boiler** | L | **100** |
| **Weight** | kg | **425** |
| **Chimney cross-section** | mm | **150** |
| **Required chimney draft** | mbar/Pa | **0.12/12** |
| **Boiler temperature (min/max)** | °C | **60-90** |
| **Min. temperature of the return line** | °C | **60** |
| **Efficiency rate** | % | **90.3** |
| **Nominal power** | (kW) | **18.07** |
| **CO emission with rated heating power (10%$O_2$) *** | ($mg/m^3$) | **126.57** |
| **$NO_x$ emission with rated heating power (10%$O_2$) *** | ($mg/m^3$) | **175.75** |
| **OGC emission with rated heating power (10%$O_2$) *** | ($mg/m^3$) | **5.02** |
| **Dust with rated heating power (10%$O_2$) *** | ($mg/m^3$) | **18.44** |
| **Dimensions** | | |
| | A | **410** |
| | A1 | **504** |
| | B | **990** |
| | B1 | **1283** |
| | C | **1124** |
| | D | **150** |
| | E | **132** |
| | F | **419** |
| | G | **1113** |
| | H | **1120** |
| | I | **1409** |
| **Hot boiler water connections** | D1 | **1"** |
| **Cold boiler water connections** | D2 | **1"** |
| **Connections for boiler filling and emptying** | D3 | **1/2"** |
| **Connections for air bleeding valve and pressure safety valve** | D4 | **1/2"** |
| **Connection for flow out valve for thermal safety VTO** | D5 | **3/4"** |
| **Connection for probe for thermal valve** | D6 | **1/2"** |

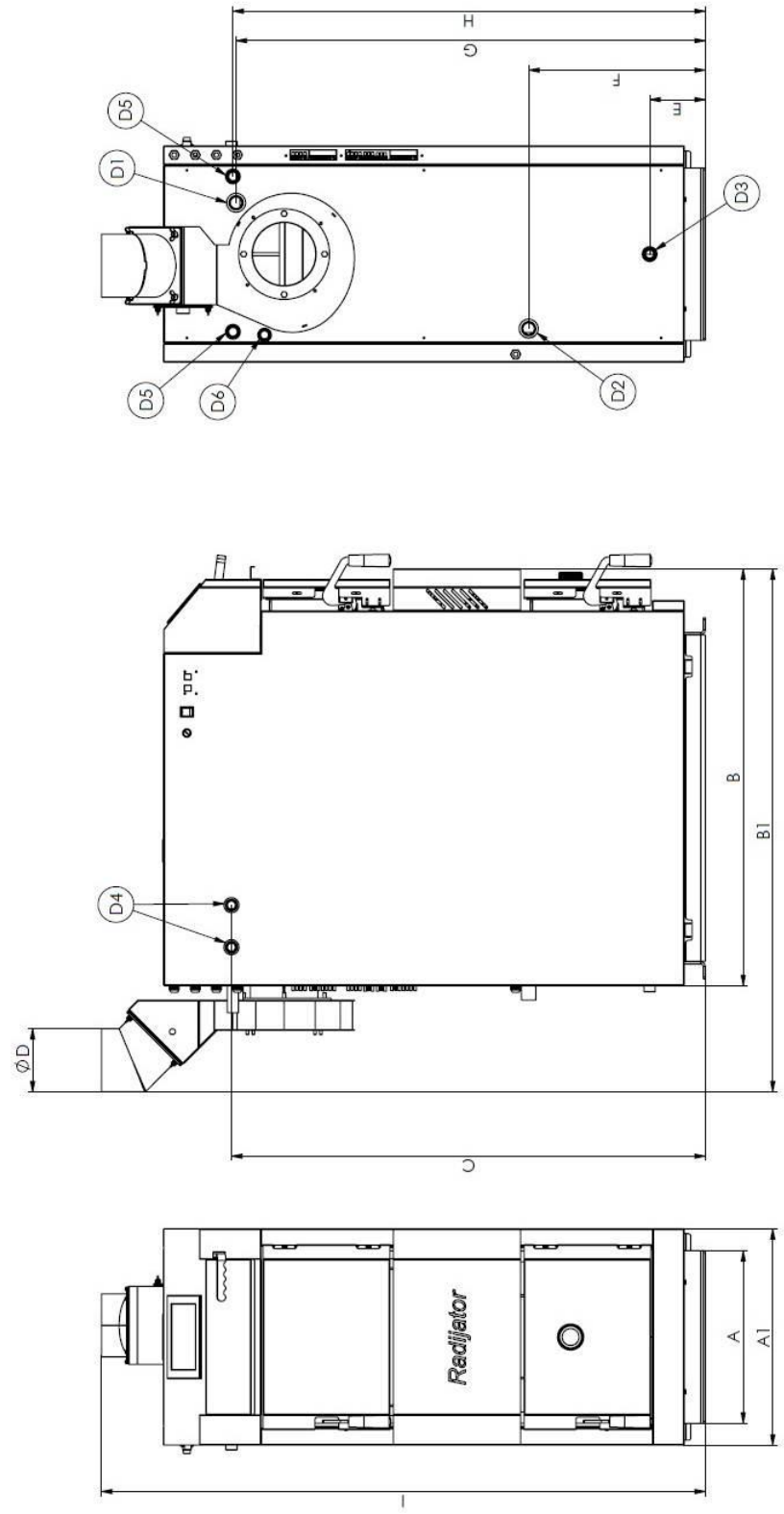



*Figure 33. Boiler projection with dimensions*

**** NOTE: These are the values measured during certification.***

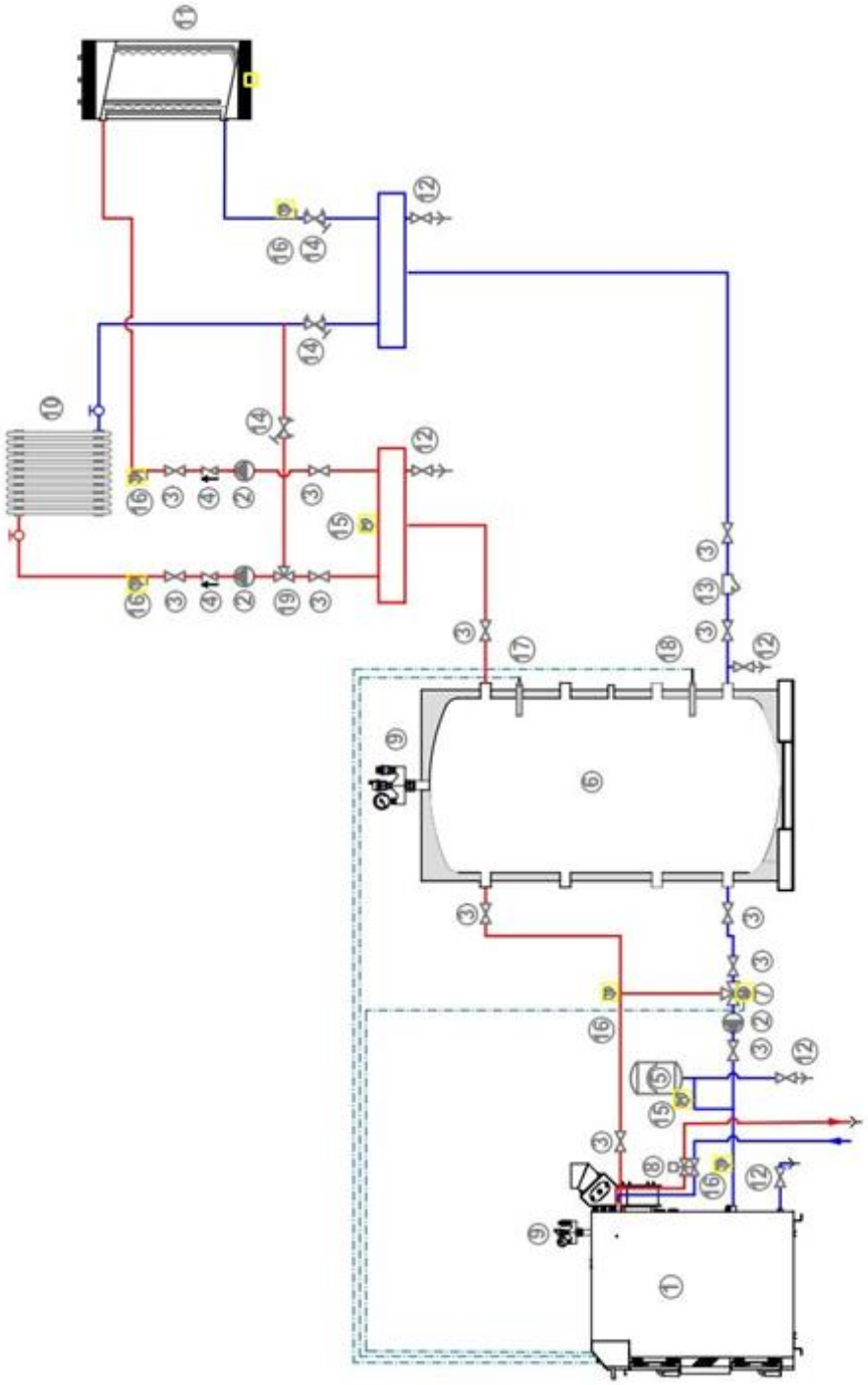
# 6. Hydraulic diagram

***During the connecting to the hydraulic installations, the boiler has to be adequately secured so that the maximal temperature and pressure are not exceeded.***

***Central heating fitter is responsible for adequate installation and connecting of the boiler to the hydraulic system.***

***Radijator Inženjering, as the manufacturer of the boiler, does not take any responsibility for the damage caused by inadequate installation of the boiler.***

***If the installation is not done according to the regulations, i.e. does not contain the elements shown in the recommendations of the company "Radijator inženjering", THE WARANTY WILL NOT BE ACCEPTED.***



Legend: 1. PYROLYTIC BOILER PK18, 2. CIRCULATION PUMP, 3. VALVE, 4.NON-RETURN, 5. VALVE EXPANSION VESSEL, 6. ACCUMULATION VESSEL, 7. 3-WAY MIXING VALVE WITH ELECTRIC ACTUATOR, 8. THERMAL INSURANCE VALVE, 9. SAFETY GROUP (THERMAL INSURANCE VALVE+MANOMETER+SELF-VENTING VALVE), 10. EXCHANGER, 11. SANITARY WATER HEATER, 12. FILL AND DRAIN VALVE, 13. STRAINER, 14. REGULATION VALVE, 15. MANOMETER, 16. THERMOMETER, 17. ACCUMULATION TEMPERATURE PROBE IN THE UPPER ZONE, 18. ACCUMULATION SENSOR PROBE IN THE LOWER ZONE, 19. 3-WAY MIXING VALVE.

*Figure 34. Hydraulic scheme with accumulator and sanitary water heater PK18*

# 7. Boiler starting and maintenance

## 7.1. Boiler starting and stoking

- Inside the boiler there is a flap for directing the flue gas in two modes “operating” and “ignition” position. This flap is operated by the handle on the front side of the boiler. Move the handle towards you and lock it using the notch on the handle. The flap is the in the “ignition” position. ***(Figure 35)***

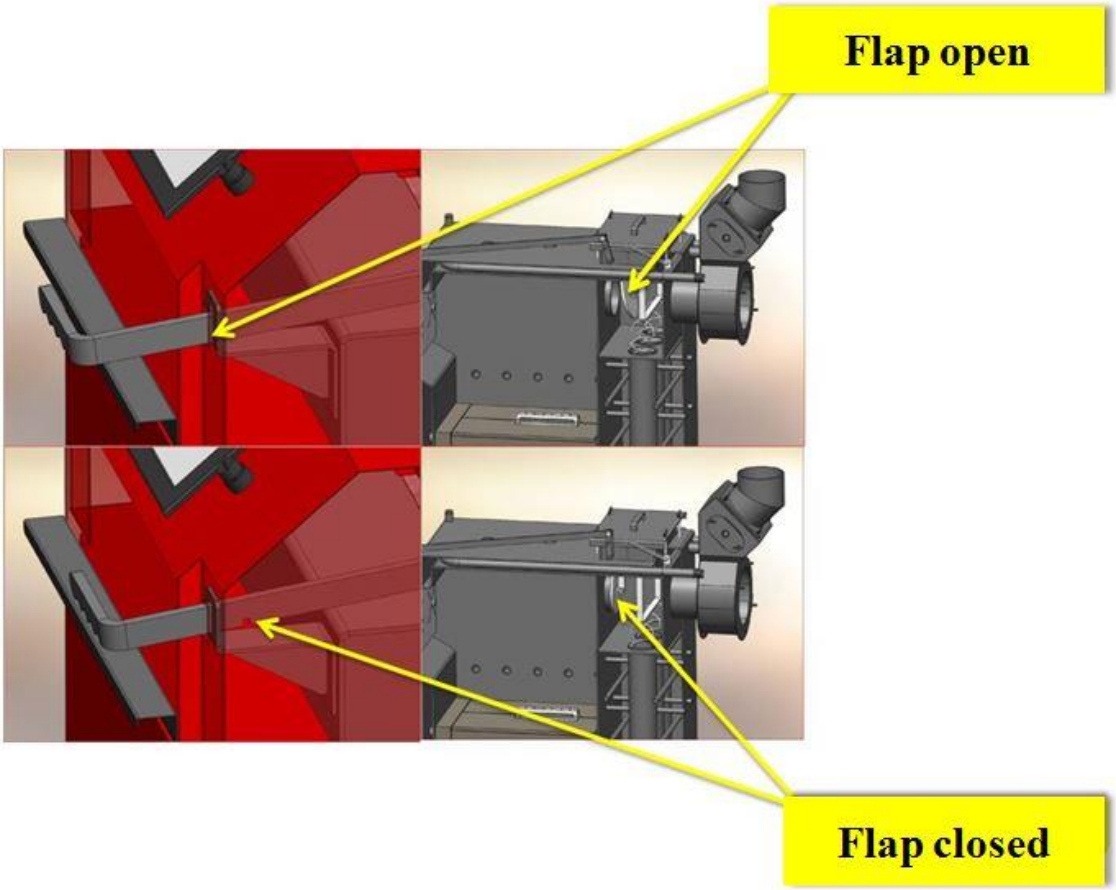



*Figure 35. Positions of the flap and the flap handle in the “operation” and “ignition” mode*

- If the boiler was previously fired, the ash has to be removed from the firebox. Stack small branches and small pieces of wood on the bricks, and place crumpled paper over it and then place some more branches up to the height of the primary air opening located on the lateral sides of the firebox. Stack firewood lengthwise over it. Stack them up to the half of the total height of the firebox. ***(Figure 36)***

*Figure 36. Wood in the boiler*

- Press the automation button ***(Figure 37).*** On the display, you can now read that the ignition process is in progress, which may last up to 30 minutes. At this time, the fan is working at maximum power. If the ignition is not successful, the boiler would shut down.

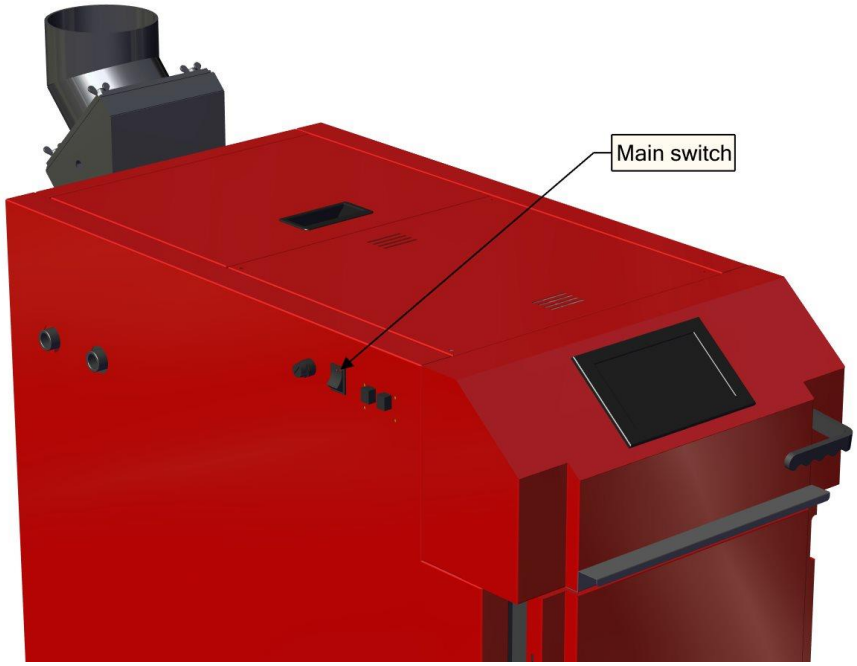



*Figure 37. Main switch*

- Before firing the boiler, the lower door has to be slightly opened. It is also important for the primary air flap to be open, while the secondary air flap has to be closed. ***(Figure 13)*** This can be verified by removing the mask located between the upper and lower doors of the boiler. The mask can be simply removed by slightly lifting it upwards and pulling it towards you.

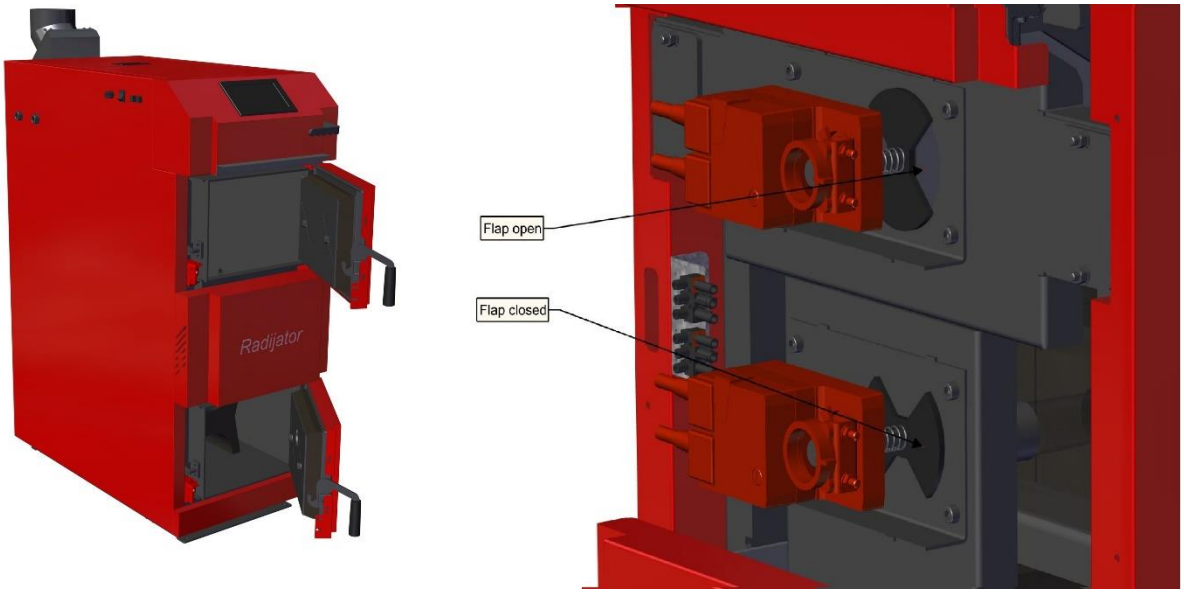



*Figure 38. Upper and lower doors open and primary air flap open*

1. After this, it should be possible to fire up the boiler.
2. When the flame is formed in the firebox, the upper door needs to be closed and the lower door need to stay slightly open, so that the flame could reach the highest possible amount of fuel.
3. When the flue gas temperature probe detects the temperature required for the boiler to enter the operating mode (burning), the lower door has to be closed. The lower door should not be opened again during the entire burning process. Lower door should be opened only after the burning process is complete, i.e. when the boiler needs to be cleaned.
4. It is necessary to move the flue outlet flap from the locking position, i.e. move the handle towards the flue outlet, and then the flame would move downwards to the draft slot and achieve pyrolysis.
5. After the initial stacking (while the boiler is still in the burning phase), refill the firebox with fuel. At this point it is necessary to pull the flue outlet flap towards you and lock it in this position, thus opening the flue outlet and allowing the flame to go directly into it. The upper door should be opened in a way that you first hold it slightly open and after several seconds start with the refilling. The firebox should be refilled quickly to avoid excessive flue gas temperatures. After the refilling of the firebox, the upper door needs to be closed and immediately after this we can move the flue outlet flap from the locked position into the closed position. After this, the pyrolysis process runs without interruptions.

## 7.2. Maintenance and cleaning of the boiler

"PK 18" series boiler requires daily and periodical cleaning.

- Daily cleaning relates to the cleaning of the upper combustion chamber, as well as to lower combustion chamber.
- A layer of soot and tar relatively quickly forms in the boiler when solid fuel is being used. Therefore, it is recommended to clean the ash and the firebox on a daily basis. Use the tools supplied with the boiler to clean and maintain the boiler. Use the shovel or scrapper to remove dried and burned residues peeling of the walls and corners of the firebox (ash, coal and tar).

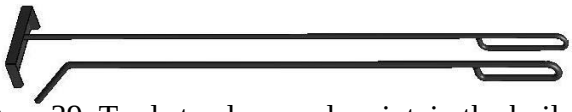


Figure 39. Tools to clean and maintain the boiler

- Also clean the primary air openings.
- Furthermore, it is necessary to open the cover of the turbulator cleaning and disassembly opening, remove the turbulators and clean the turbulator pipes. ***(Figure 40)*** After cleaning, the cover has to be refitted and tightened to ensure proper sealing.

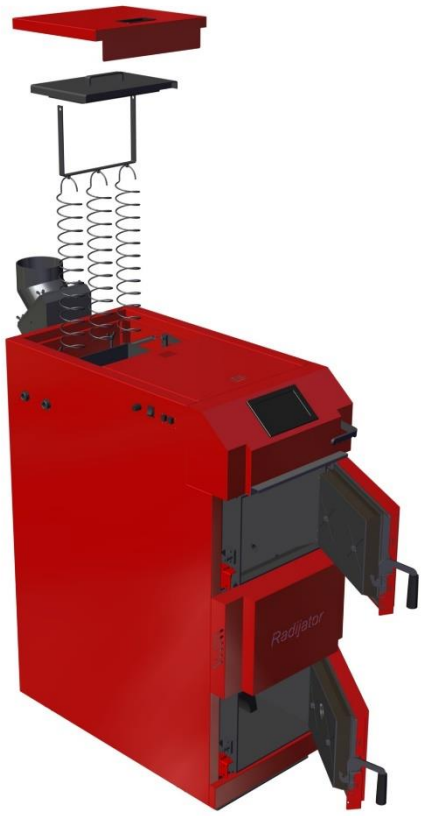


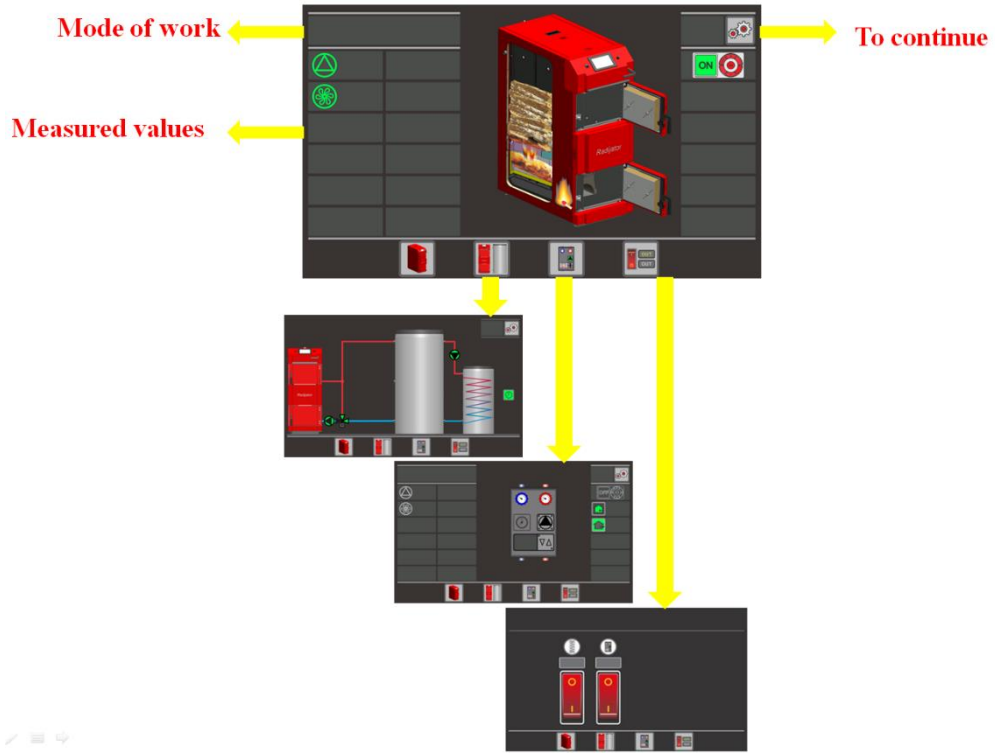

*Figure 40. Upper and lower door open and turbulators removed*

- While cleaning, certain amount of fresh air has to be introduced into the boiler room to prevent suffocation of the operator.
- After a thorough cleaning of the boiler, intensive stoking should be done for one hour so that the temperature in the boiler reaches 85 °C which contributes to the burning of soot and harmful materials in the firebox. This would result in the higher degree of utilization of the boiler.
- We recommend for the chimney sweeper to perform regular inspection.
- After the heating season is over, the boiler should be thoroughly cleaned and all the doors should be closed, including the primary and secondary air flaps and firebox flaps. This prevents flow of air through the boiler during the summer period, i.e. eliminates the possibility of excessive cooling of firebox walls and turbulator pipes and forming of dew. Potential forming of dew during the summer also has a negative impact on the useful life of the boiler.

**Small cracks on the surface of the fire-resistant concrete are perfectly normal and do not affect the functioning and the lifetime of the elements. Black residue on the interior walls of the filling chamber is normal and need not be removed.**

## 7.3. Short automation instruction

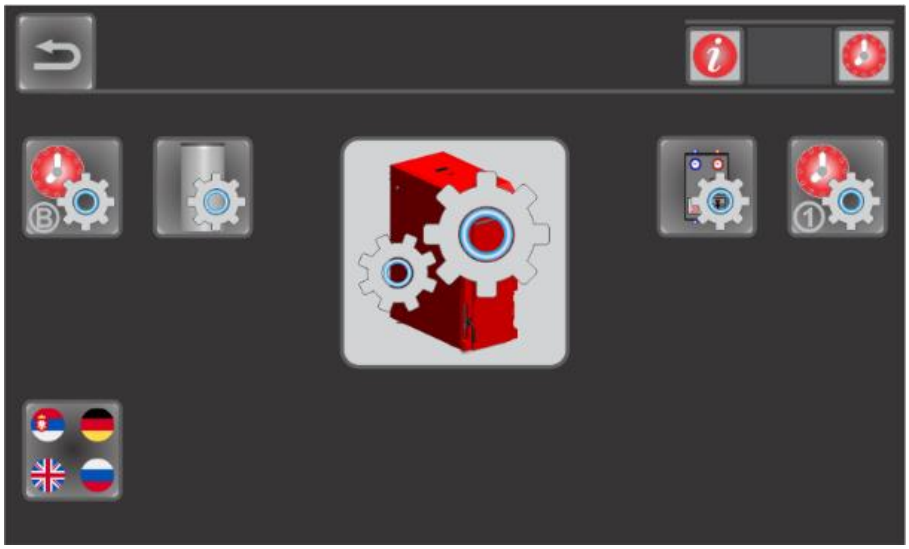
### 7.3.1. Basic appearance of the display




### 7.3.2. To continue

If you wish to move on to the next setting, press  in the upper right corner.


In this case, the display shows:



To return to the previous setting on the screen, press in the upper left corner.

### 7.3.3. Change of date

If you wish to change the time, press the icon in the upper right corner. The display shows:

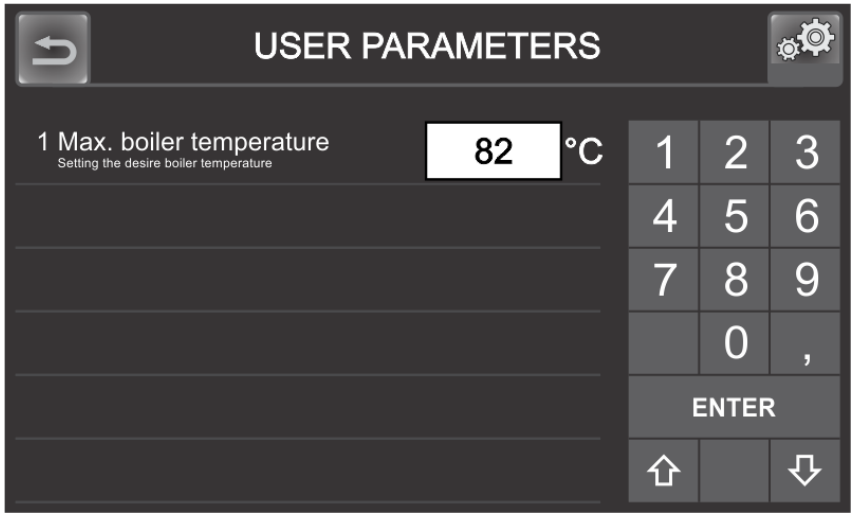

By pressing the desired day, you change the day of the week.

To set the time, first press the hour and enter the value using the buttons. It is necessary to confirm with ENTER after you enter the desired value. After this, repeat the procedure for minutes.

After you finish, press the icon .

### 7.3.4. Sanitary water

To set the desired temperature of the sanitary water, press the icon in the main menu.




Use the keypad to enter the desired value (for example, 60°C, as in the figure). It is necessary to confirm with ENTER.

After you finish, you must press the icon .

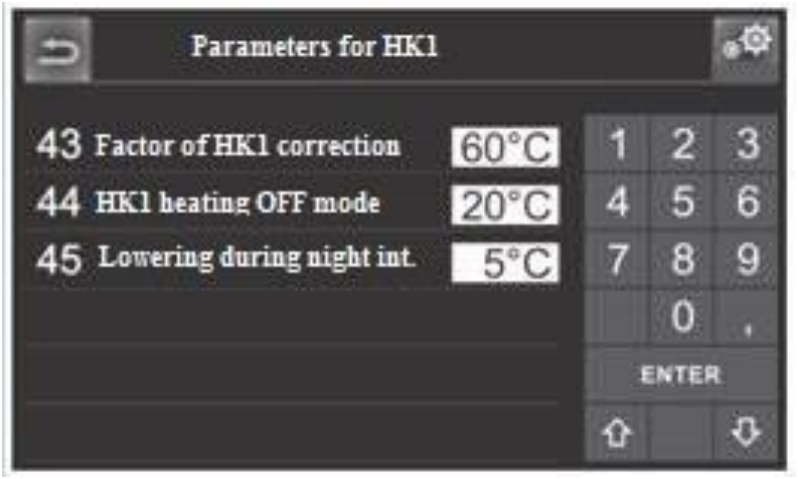
### 7.3.5. Change of language

To change the language, press the icon .

After choosing the language, press the icon .

### 7.3.6. Change of the basic heating parameters

To change the basic heating parameters, select the icon .

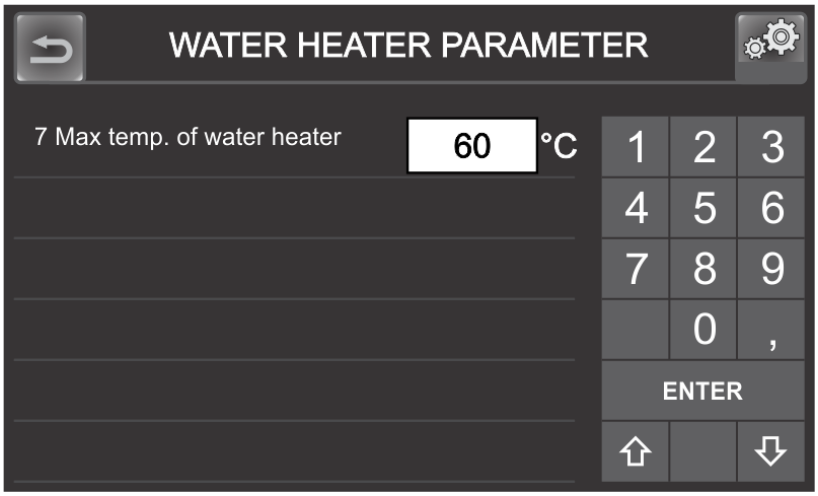



Change the value of the parameter using the keypad. It is necessary to confirm with ENTER.

After you finish, you must press the icon , so that the settings would be saved.

### 7.3.7. Change of the basic boiler parameters

To change the basic boiler parameters, such as the maximal temperature of the boiler water, press the icon .



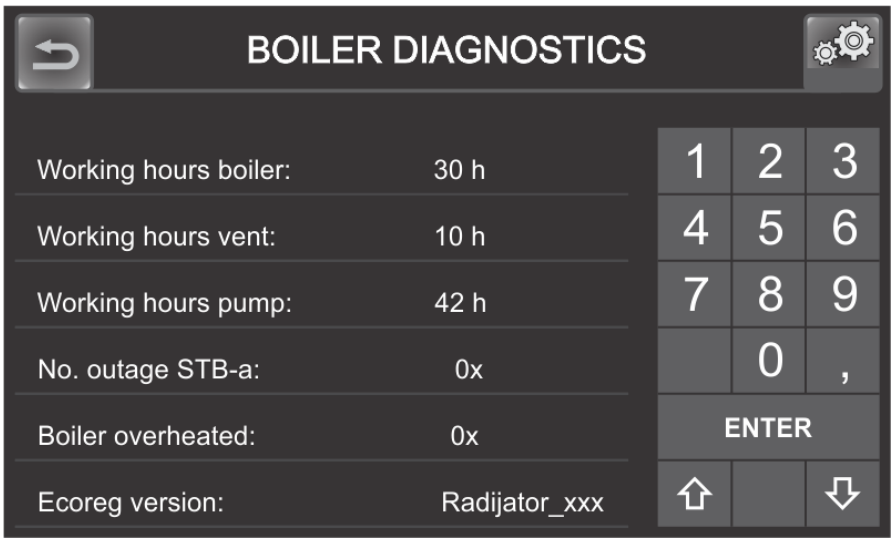

*The figure is symbolic.*

Change the displayed parameter by pressing the parameter value (in this case 85°C) and using the keypad to enter the new value, and then confirm with ENTER.

Press the icon so that the change would be saved and to return to the previous screen.

### 7.3.8. Basic information about the boiler

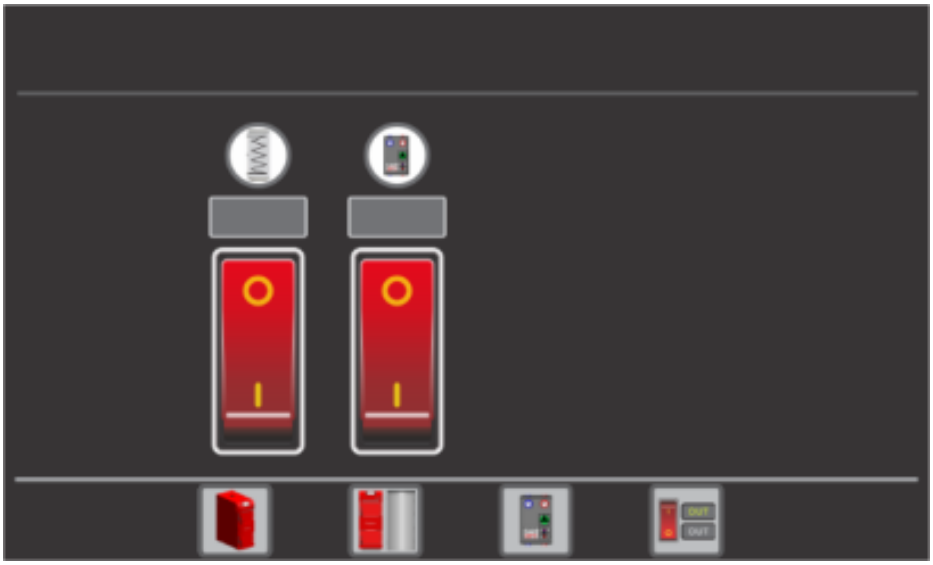
To review the basic information about the boiler, press the icon . The basic information would appear on the screen, such as: total length of boiler operation, length of fan operation, total length of pump operation, number of STB interruptions, was the boiler overheated and the version of EcoReg.




To return to the main menu, press .

### 7.3.9. Manual operation

There is a possibility to manually control your system, i.e. to turn the system parts on and off (accumulation, heating circles). Simply press the switch shown in the figure below.



# 9. Warranty

2. **Radijator inženjering covers the warranty period of 60 MONTHS only if following warranty conditions are fulfilled:**

   2.1. The boiler must be connected according to the technical diagrams given in technical instructions; special attention should be paid to safety valves, thermal safety by draining, mixing valve for protection of cold end of the boiler, i.e. for protection against condensation, boiler operating pressure range, boiler operating temperature range, conditions in the boiler room etc. **(See items 3 and 6)**

   2.2. The boiler must be connected to the chimney with prescribed cross-section, insulation and height. **(see item 3.4)**

   2.3. The uptake from boiler to the chimney must be done according to the technical instructions.

   2.4. The owner must follow stated instructions for use and maintenance. **(See items 7.1 and 7.2)**

3. **Warranty declaration**

We declare:

- that the product has prescribed and declared quality characteristics.
  We are obliged, at the request of the buyer if such request for repair is submitted in due time and in the warranty period, at our expense, to carry out all repairs of damages, in such way that the product will operate in accordance with declared characteristics,
- that the product will operate without fault during the warranty period if all the instructions for use, operation and installation are followed,
- that in the warranty period we will be ready to eliminate all damages on the product and keep in stock all necessary spare parts,
- **the warranty period starts from the DAY OF PURCHASE AND LASTS 60 MONTHS OR 72 MONTHS FROM THE DATE OF MANUFACTURE (date of manufacture is specified on the label on the back side of the boiler)**
- **the warranty is valid if the warranty card is stamped by the seller and if date of purchase is written on it and the bill is enclosed.**

4. **Warranty period of one year is valid for the following parts:**

- bricks in the firebox,
- Automation system of the ECOREG 1750 boiler and the sensor regularly delivered with the automation system (flue gas temperature sensor, sensor for temperature of water in the boiler, sensor for temperature of water in the return line, temperature sensor in the upper zone of accumulation temperature sensor in the lower zone of

accumulation, sanitary water, outdoor temperature sensor, sensor for temperature of mixed heating circuit, Lambda probe).

**5. Warranty period of two year is valid for the following parts:**

- BELIMO actuators for regulation of primary and secondary air.

**6. Warranty period is not valid:**

- for damages caused by the buyer due to poor handling of the product,
- for mechanical damages made during transport and in use (solid objects),
- if the product is unprofessionally installed, contrary to the valid regulations in that area,
- if the buyer has used the product above the declared characteristics and in normal conditions,
- if it is determined that the technical diagram was not done according to the recommendations of the company "Radijator inženjering",
- if it is determined that the boiler was not regularly maintained and cleaned during the use,

**7. Warranty period becomes invalid:**

- if it is determined that damage has been repaired by unauthorized person or unauthorized service shop,
- if original parts were not used and installed during the repair,
- if warranty period expires.

**8. When reporting damages, the following details must be provided:**

- name and type of the product,
- date of purchase,
- factory or workshop number of the boiler,
- brief description of malfunction, i.e. the shortcoming,
- exact address and contact phone number, e-mail.

# *GARANTNI LIST / GUARANTEE LIST*

**Tip kotla / Boiler type**

**Fabrički broj / Factory No.**

**Garantni rok / Guarantee period** **60 MESECI/ 60 MONTHS**

**Datum proizvodnje /**
**Date of manufacture**

**Potpis ovlašćenog lica /**
**Signature of Authorized person**

pečat / stamp

**Prodato u firmi / Company of Sale**

**Adresa / Address** **Telefon / Phone**

**Datum prodaje / Date of Sale**

**Potpis / Signature**

pečat / stamp

**Potrosač ima sva prava na osnovu Zakona o zaštiti potrošača ("Sl.glasnik RS", br. erbia62/2014). Garancija ne isključuje niti utiče na prava potrošača koja proizilaze iz zakonske odgovornosti prodavca za nesaobzirnost robe u ugovoru./ The consumer shall exercise all rights under the Consumer Protection Law ("OJ of RS" No 62/2014). The guarantee does not exclude nor affect the consumer's rights derived from the legal liability of the seller for any lack of conformity of the goods under a Contract.*
**Gore navedeno važi za kupce na prostoru Republike Srbije./ The aforementioned applies to purchasers of the Republic of Serbia.*