Inspection of boilers and heating systems

Prof.Dr.Ing. OCTAVIA COCORA

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forward

- **Requirements of 2002/91/EU art.8 and 2010/31/EU art.14**

  - Regular inspection of accessible parts of heating systems (heat generator, control system, circulation pumps, etc.) with boilers more than 20 kW

  - MS set the inspection frequencies depending on the heating rated output, the costs of the inspection and the estimated energy cost savings

  - Regular inspection of heating systems with boilers over 100 kW every 2 years or 4 years (gas)

- **EN 15378 defines two separate procedures**

  - for boilers ⇨ regular inspection

  - for entire heating systems ⇨ one – off inspection

- **The main goals of inspection**

  - screening – weak points of energy consuming systems

  - advices – solutions to improve the energy performance of existing heating systems and to decrease the consumption

- **In Romania, safety check of boilers is mandatory due to ISCIR regulation**

  - first safety check ⇨ when bringing into operation

  - regular technical safety check ⇨ depending on power and fuel

Content of the inspection guide

1. Introduction: scope, area of application
2. General procedure of inspection
3. Boiler inspection procedure
4. Heating systems inspection procedure
5. Inspection report (art. 16 of 2010/31/EU)
    - 5.1. Heating station and boiler inspection report and inspection files FIC, FP, FA
    - 5.2. Heating installation inspection report and inspection files FIE, FID, FIG, FIA
6. Informative annex 13 (A - M)

Bibliography

2. General procedure of inspection

2.1. Heating systems inspection procedure refers to:

- **verification of the way the heating system is set up, operate and maintain, in terms of energy efficiency**
- **evaluation of current energy performance of the heating system**
- **recommendations on possible improvements of the energy performance of heating system and key information to the end user**

2.2. The complexity of the energy inspection is related to one or more of the following parameters:

- type of boiler
- type of fuel used
- nominal boiler power
- heated surface or volume
- type of heat distribution
- type of heating equipment

3. Boilers inspection procedure

- 3.1 Identification of the boiler
- 3.2 Collection of documentation
- 3.3 Visual inspection of the boiler
- 3.4 Status of boiler maintenance
- 3.5 Checking the functionality of the boiler
- 3.6 Check the control system of the boiler
- 3.7 Meter reading
- 3.8 Evaluation of boiler energy performance
- 3.9 Boiler inspection report and recommendations

4. Heating systems inspection procedure

- **4.1 Identification of the heating system**
- **4.2 Checking the functionality of the heating system**
- **4.3 Level of heating system maintenance**
- **4.4 Visual inspection of control heating system**
- **4.5 Heat emission system**
- **4.6 Control of heat emission system**

continuation

- **4.7 Heat distribution system**
- **4.8 Heat generation system**
- **4.9 Fuel consumption for heat generation**
- **4.10 Checking the capacity of heat generating system compared with the heating requirements**
- **4.11 DHW system**
- **4.12 Heating system inspection report and recommendations**

5.1. BOILERS AND THERMAL STATION INSPECTION REPORT

1. Beneficiar identification

- Name owner / manager
- Address: city, street, no

2.Date of inspection

3.Purchase identification expert for heating

- (Name, certificate number)

4. Description of boiler

- Thermal station type (apartment, building, area)
- Thermal power plant (kW)
- Type of product heat (warm water, hot water, steam)
- User heat (heating,domestic hot water, air conditioning, technology process)
- Type of fuel used (natural gas, LPG, liquid, solid)
- Boiler location (above ground, half buried, underground, in the building)
- Dimensions (length, width, height, area, total volume, net volume)
- Building structure (including access to thermal station)
- Location of the chimney (in the building, attached building, independent)
- CT windows surface (check according to the regulation)
- Providing combustion air (grid, channels, preheated, etc..)

5. Technical documentation of thermal station (project execution, technical report, functional scheme, etc..)

6. Technical operation and maitenance documentation of thermal station (maintenance reports, recorded values, etc..)

continuation

7. Technical data and thermal power of boiler

- Number and type of boilers
- Operation of the boiler system (continuous, cascade, winter / summer)
- Inspection files of boilers: FIC 1 ..... n

8. Type of heat distribution

a) distributor - collector
b) pressure equalizing - BEP
c) direct distribution

9. Technical data of pressure protection system

- Local protection devices
- Pressure protection system, inspection file: FA

10. Technical data of circulating pumps

- Type of pumps (recirculating pumps, heating circulating pumps, technology, supply pump, etc.)
- Inspection files of pumps: FP 1 ... n

11. Domestic hot water system inspection

- Type of heat exchanger (no accumulation, with accumulation)
- Number and capacity of heat exchangers
- Number and capacity of storage tanks
- Domestic hot water supply system (route, pipes, pumps)

12. Technical data concerning the fuel system

- Tank / fuel store (location, capacity, day tank, etc..)
- The supply of fuel (automobile, railway, gas pipelines, etc..)
- Intangible reserve of fuel
- Energy consumption to improved the fluidity of heavy liquid fuel

continuation

13. Information on thermal station utilities (water, sewer, electricity, etc..)
14. Thermal station own energy consumption (electrical, thermal)
15. Information on water losses in the system (volume, temperature)
16. Information on treatment addition water station (type, capacity, etc..)
17. Consumption of chemicals for water supply treatement
18. Equipment for filtering, cleaning and air evacuation system
19. Equipment and devices for recording the consumption (heat meter, electricity meter, water meter, etc..)
20. Record fuel consumption (gas meter, fuel bills, etc..)
21. Automation and control of heat supply (quality control, quantity control, three-way valves, etc..)
22. Equipment and measuring devices installed on the boiler (thermometers, flow meters, pressure gauges, etc..)
23. Hydraulic balancing devices and systems (at thermal station level and consumer level)

continuation

24. Balancing systems and devices on the route of the flue gas exhaust
25. General information on the state of thermal station and equipment **(state of physical wear, state of thermal insulation, loss of water and fuel, etc.)**
26. Analysis of records of hot water temperature and outdoor temperature (if any)
27. Conclusions and recommendations of the expert regarding thermal station and boiler inspection

(see under: **- Annex M, measures to increase the energy efficiency - Annex H, investment evaluation to replace the boiler**)

28. ATTACHMENTS: **(documents, data sheets, measured and recorded values, etc.)**

Date

Name and signature

5.2. INSPECTION REPORT OF HEATING AND DHW

1.Beneficiar identification

- Name owner / manager
- Address: city, street, no

2.Date of inspection

3.Purchase identification expert for heating

- (Name, certificate number)

4. Description of building

- Destination and category of building (residential, non residential)
- The climate and outdoor temperature (using SR 1907)
- The operation of the building (permanent, intermittent - hours / day)
- Age of building
- The height of the building
- Height level
- Total area built
- Total area heated
- Volume of heated
- Type of construction (load-bearing walls, frames + masonry, precast panels, ventilated facades, etc..)
- Type of building thermal insulation (exterior, interior, intermediate)
- Quality of thermal insulation (original, improvised, good, damaged)
- Heated areas (room type)

continuation

5. Description of the heating installation

- Year of heating system installation
- Technical documentation of the installation (project execution, technical report, the layout of the heating elements, functional shema, etc..
- Metered values of heat and fuel consumption
- Type of heat (warm water, hot water)
- Heat demand for heating (W) (the technical report or under Annex G)
- The connection of the heating supply system with heat (direct connection, connection through heat exchangers, etc.)
- Appropriate location of the main components of the heating system (heating fixtures, equipment control and monitoring, etc..)
- Operating within normal parameters (yes / no)
- Auxiliary heating systems (electric, renewable, etc..)

6. Characteristics of emission heating elements – FIE file

7. Characteristics of heat distribution system – FID file

8. Characteristics of heat generation system and size verification– FIG file

9. Characteristics of DHW system – FIA file

10. General comments about the quality of the heating and hot water supply (thermal insulation condition, loss of water or fuel, etc.)

11. Conclusions and advices (refer to: - Annex M, for measures on the operation and efficiency of heating, Annex I, for advice on heat distribution system , Annex J and K, for advice on heat emission system and Annex L, for advice on domestic hot water)

12. ATTACHMENTS: (documents, data sheets, measured and recorded values, etc..)

Date **Name and signature**

FIC 1 ..... n
INSPECTION FILE OF BOILER

1. Numele proprietarului/administratorului

2. Adresa

3. Producătorul,modelul şi seria:

4. Anul fabricaţiei

5. Certificare — CE / Non - CE

6. Combustibilul utilizat

7. Modul de alimentare cu combustibil — manual / automat

8. Amplasarea cazanului — montat pe podea / montat pe perete

9. Utilizarea cazanului — încălzire / preparare apă caldă menajeră / ambele

10. Funcţionare cazan — funcţionare după curba de reglaj / funcţionare la temperatură constantă

11. Regimul de funcţionare al cazanului — continuu / intermitent (16 ore/zi iarna şi 4 ore/zi vara)

12. Cazan in condensaţie — da / nu

13. Puterea nominală de intrare

14. Puterea nominală de ieşire

15. Puterea de intrare măsurată

16. Tipul camerei de ardere — deschisă / închisă

17. Arzător integrat — da / nu

18. Tipul arzatorului — presurizat / atmosferic

19. Regimul de funcţionare al arzătorului — fix / în trepte / modulant

20. Producătorul şi modelul arzătorului

21. Puterea arzătorului

22. Tipul tirajului coşului — natural / forţat

23. Caracteristicile coşului de fum
(în cazul tirajului natural)

24. Tirajul natural al coşului de fum — suficient **(Anexa D)** / insuficient

25. Tipul exhaustorului — ventilator / ejector
(în cazul tirajului forţat)

26. Sistem coaxial pentru evacuarea gazelor arse/ admisia de aer — da / nu

27. Eficienţa cazanului la sarcina totală

28. Eficienţa la 30% din sarcina totală

29. Eficienţa sezonieră a cazanului **(Anexa F)**

30. Eficienţa de combustie **(Anexa B)**

31. Inspecţie vizuală — DA **(Anexa A)**

Metered and countered values (Anexa B)			
Contor combustibil	N.D	Nivelul combustibilului	N.D
Numărul de ore de funcţionare ale arzătorului	3360 h	Numărul de ore de funcţionare ale cazanului	N.D
Număr cicluri pornit/oprit ale arzătorului	N.D	Contor energie termică	N.D
Apometru apă rece	180 m^3	Apometru apă caldă menajeră	110 m^3
Notă: N.D=nu este disponibil			

Basic settings for the boiler - measured values and reference values						
O_2	CO	Temperatura gazelor de ardere	Temperatura aerului admis	Temperatura agentului termic	Eficienţa de combustie	Condiţii
%	Ppm	°C	°C	°C	%	-
5,2	20	162	12	64	96,71	Măsurate la sarcina totală
8,4	52	142	12	58	95,91	Măsurate la sarcina minimă
2-4	< 100	120 … 160	-	-	>92	Valori de referinţă

Boiler settings		
Numele verificarii	Setarile actuale	Setarile recomandate
Temperatura cazanului	65 °C	OK
Temperatura apei calde menajere stocate	60 °C	50 °C

• **Evaluation of fuel consumption** **(Anexa C)**

32. Consumul anual de combustibil **Nm³/an**
(estimat pe baza facturilor din ultimii ani)

33. Consumul anual de combustibil pentru gătit **Nm³/an**
şi prepararea apei calde menajere
(estimat pe baza facturilor din timpul verii)

34. Consumul anual de combustibil pentru încălzire **Nm³/an**

• **Evaluation of boiler's capacity vs. heat demand** **(Anexa G)**

35. Capacitatea cazanului este în conformitate cu necesarul de căldura al clădirii.

36. Capacitatea cazanului este prea mare în raport cu necesarul de căldura al clădirii, trebuie făcută o reevaluare în vederea înlocuirii.

37. Capacitatea cazanului este prea mică în raport cu necesarul de căldura al clădirii, trebuie făcută o reevaluare în vederea înlocuirii.

● **Assessment of investment necessary to replace the boiler (if applicable)**

Conform standardului european de inspecţie a cazanelor şi a sistemelor de încălzire, evaluarea investiţiei necesare pentru înlocuirea cazanului se face doar pentru cazanele a căror eficienţă sezonieră este cuprinsă între 70 şi 80 %.

38. Cazan _____ RON

39. Manopera montaj cazan _____ RON

40. Totalul investiţiei _____ RON

● **Evaluation of investment depreciation (Anexa H)**

41. Economii anuale la facturile de combustibil _____ RON/an

42. Economii anuale la facturile de energie electrică _____ RON/an

43. Economii anuale privind costurile de mentenanţă _____ RON/an

44. Totalul economiilor _____ RON/an

45. Timpul de amortizare a investiţiei _____ ani

● **Recommendations for improving energy efficiency (Anexa M)**

6. Informative annex 13 (A - M)

Annex A - Visual inspection of boilers and basic settings check
Annex B - Flue gas analysis
Annex C - Evaluation of fuel consumption and auxiliary energy for heating and domestic hot water generation
Annex D - Verification of the exhaust system of flue gas
Annex E – Evaluation of combustion power of the boiler
Annex F - Establish seasonal boiler efficiency
Annex G - Evaluation of the heating need of the building and compare with boilers and heating systems capacity
Annex H - Evaluation of pay - back of the investment in boiler replacement
Annex I - Inspection of heat distribution system
Annex J – Inspection of heat emission system
Annex K - Thermal stratification in rooms with high ceilings
Annex L – Inspection of domestic hot water supply system
Annex M - List of possible recommendations to increase energy efficiency of boilers and heating systems

THANK YOU FOR YOUR ATTENTION!