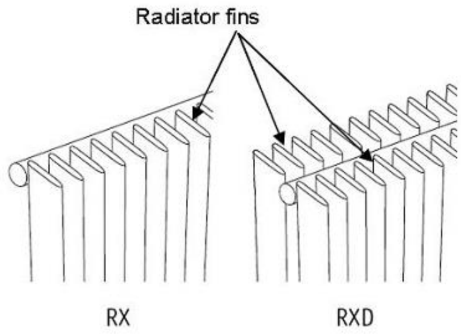
**Nom:** **Date:**

**HVAC Learning.com**

# Exercise Booklet

*Print this exercise booklet before studying the lesson on-line. It will enable you to write your answers to the HVAC learning exercises. You will thus be able to switch between reading or listening to the file on-line and writing in the booklet.*




## SELECTION OF HOT WATER EMITTERS

*English lesson*
https://hvac-learning.com/heating/heat-emitters-and-boilers-training/selection-of-hot-water-emitters/

*French version:*
https://formation.xpair.com/cours/selection-emetteurs-eau-chaude.htm
https://formation.xpair.com/cours/emetteurs-de-demain.htm

*For each exercise, you will write your answer, then you will study its correction on-line before going to the next exercise.*
*If you cannot do an exercise, you will be able to study its correction directly, but* ***force yourself to write your answer*** *as often as possible.*

*Note that between 2 exercises, you will find it necessary to study the course. As a warning, in the booklet, you will sometimes find the following indication:*

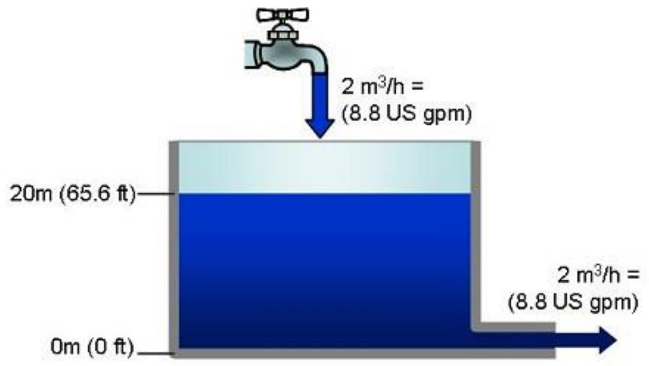
- *"* ***Study the course on-line before doing the next exercise*** *" or*
- *"* ***Study the course on-line before going to the next paragraph*** *"*

*Only study the paragraphs or the exercises which have an equal or a lower level than the one your training requires.*
*NVQ Level = Vocational Certificate*
*A Level = High school Diploma*
*HND Level = Associate's Degree*
*MSC Level = Engineering Schools*

*Then, when you have completed a file, you will be able to assess your level on-line through a Multiple Choice Questionnaire in which you will only answer the questions related to the themes you have studied.*
*So now off you go and work well!*
*Good luck!*
*The Authors.*

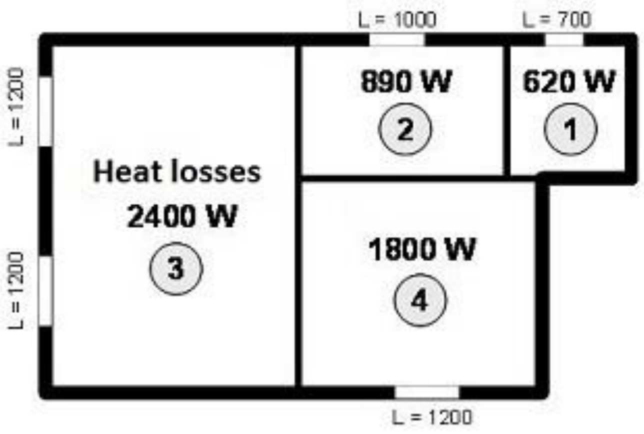
# N°1 – Thermal balance in rooms training – NVQ level

***Study the course on-line before treating the next exercise.***




Question 1

Select the electric radiators required to heat the house below. Draw up the order form.
*The radiators will be installed under the windows. Their length is less than the width of the windows.*
*We will not plan for additional power, other than that supplied by the radiator models available.*



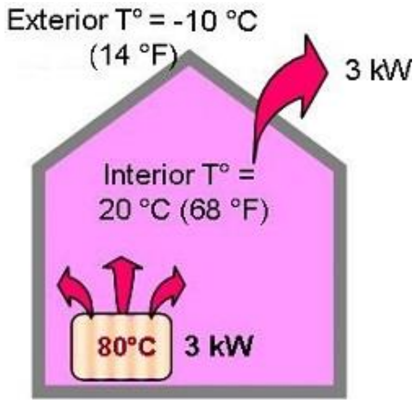

**Models available:**

| Reference | Power in W | Length in mm (inches) |
|---|---|---|
| LX500 | 500 | 400 (15.7) |
| LX1000 | 1000 | 600 (23.6) |
| LX1500 | 1500 | 800 (31.5) |
| LX2000 | 2000 | 1000 (39.4) |
| LX2500 | 2500 | 1200 (47.2) |

| Room n° | Heat loss in [W] | Ref. of the selected radiators | No. | P. installed [W] | Additional power output installed % |
|---|---|---|---|---|---|
| **1** | 620 | LX1000 | 1 | 1000 | (1000/620 – 1) x 100 = 61 % |
| **2** | ? | ? | ? | ? | ? |
| **3** | ? | ? | ? | ? | ? |
| **4** | ? | ? | ? | ? | ? |

## N°2 – Selection parameters for hot water emitters training – A level

***Study the course on-line before treating the next exercise.***

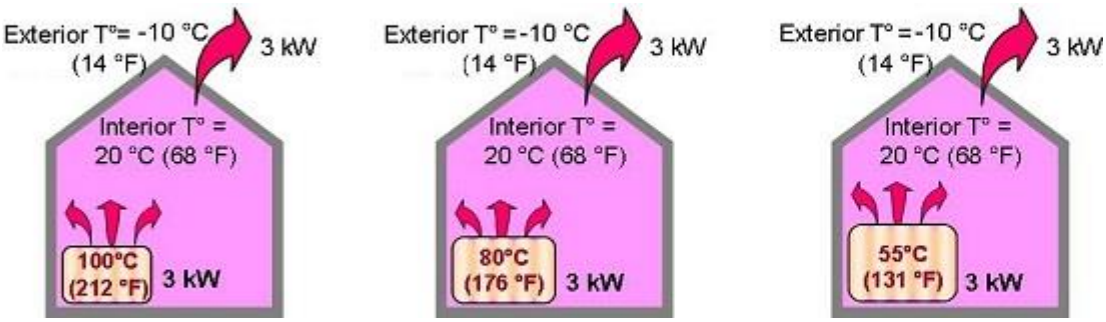



Question 1

When working in the heating sector we are continually faced with temperature differences.
We have referred to two in this paragraph:
– The temperature difference between the interior and the exterior
– The temperature difference between the radiator and the air in the room.
What allows us to determine respectively these 2 temperature differences?

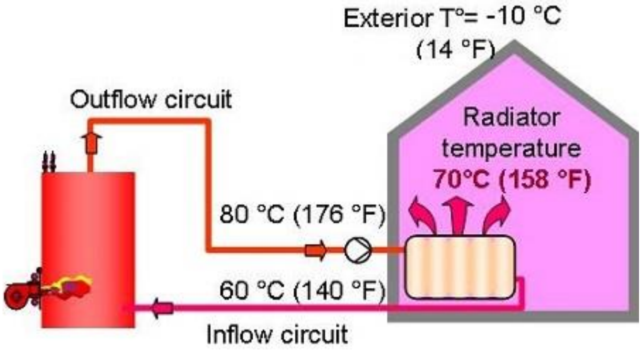
Question 2

Will the energy consumption required to heat the 3 identical premises below, respectively equipped with hot water radiators at 100, 80, 55 [°C] (212, 176, and 131 °F), in extreme cold weather conditions, be very different?



# N°3 – Temperatures of hot water emitters training – A level

***Study the course on-line before treating the next exercise.***




Question 1

In France, before the 1990's heat losses were greater (the buildings were less well insulated).
To avoid installing radiators which were too big the usual temperature regime for radiator selection was 90/70 [°C] (194/158°F).
With heating at 20 [°C] (68°F) what was the usual temperature difference indicated by manufacturers for the heat output of their radiators in the 1980's?

# N°4 – Heating water flow rates training – A level

***Study the course on-line before treating the next exercise.***

**Attention, do not confuse:**

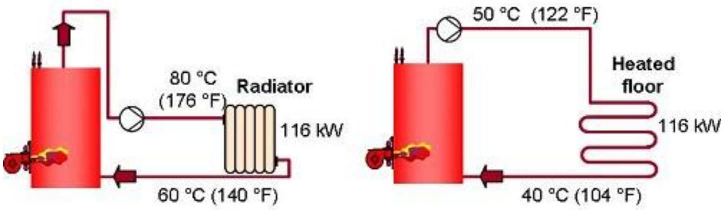
- *The ΔT between the interior and the exterior: it enables heat losses (L) to be calculated*
- *The ΔT between the emitter and the ambient air temperature (50 [K] as a general rule): it helps to select the power output (P) of the emitter, where by P ≥ L*
- *The ΔT between the water inflow and outflow of the radiator (10 to 20 [K] as a general rule): it enables the flow rate in the radiator to be calculated to give the heat loss value.*

$$q_v = \frac{P}{1,16 \times \Delta T}$$

*With $q_v$ in [m³/h], P in [kW], ΔT temperature difference in extreme cold in [K]*

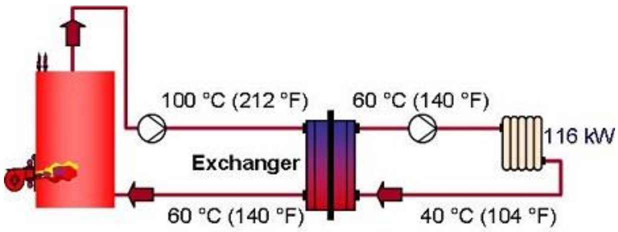
Question 1

The 2 installations below provide heating for 2 identical buildings.
Calculate the flow rates of the fitted pumps and note that their heating systems, with the same power output, are equipped with very different pumps.



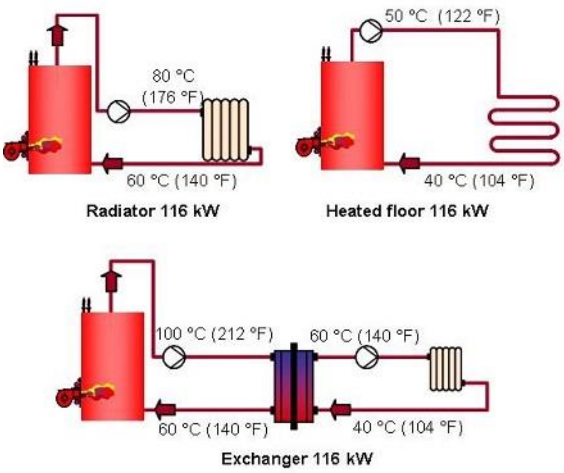

Question 2

The circuit below is fitted with a heat-exchanger.
Calculate the flow rates of the pumps on the primary and secondary circuits.



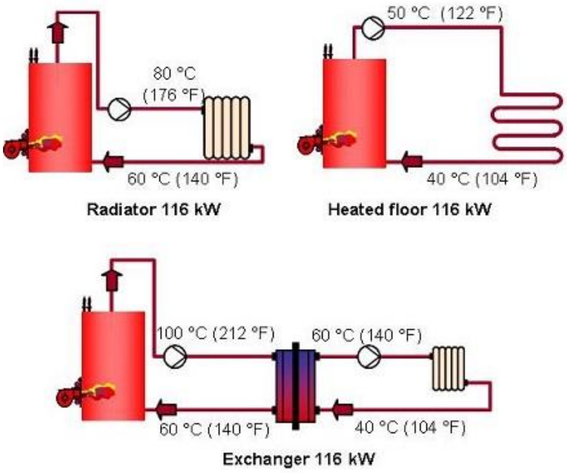

Question 3

The 3 buildings below have standard boilers.
Will the fuel consumption of these 3 buildings be very different? Why?



Question 4

Will the electricity consumption of the 3 buildings below be different? Why?




## N°5 – Temperature regime origins training – A level

*Temperature regimes stem from professional practices at both national and international levels. They are based on parameters of safety and financial economy.*

Question 1

To select a radiator with a given power output, indicate with an arrow how the risks of burning, the size of the radiator, and the water flow supply values evolve.
– If the $T_{inflow}$ of the emitter ↑, the risk of burning ↑ or ↓?
– If the $T_{inflow}$ of the emitter ↓, the size of the emitters ↑ or ↓? Why?
– For a given $T_{inflow}$ of the emitter, if the $T_{outflow}$ of the emitterof the emitter ↑, the size of the emitters ↑ or ↓? Why?
– For a given $T_{inflow}$ of the emitter, if the $T_{outflow}$ of the emitter ↑, the supply flow of the emitters ↑ or ↓?

## Question 2

Explain what was the logic behind heating network designers in the last century fixing a usual temperature of 90 [°C] (194 °F) for radiator inflow in extreme cold weather conditions?
Why not a higher temperature level?
Why not a lower temperature level?

## Question 3

Explain what was the logic behind heating network designers in the last century fixing a usual temperature of 70 [°C] (158 °F) for radiator outflow in extreme cold weather conditions?
Why not a higher temperature level?
Why not a lower temperature level?

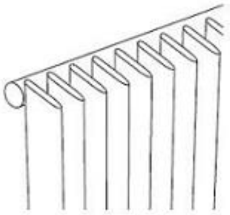
## Question 4

Explain what was the logic behind heating network designers moving from a usual temperature regime of 90/70 [°C] (194/158°F) to a regime of 75/65 [°C] (167/149°F) or even tomorrow to a regime of 53/47 [°C] (127/117°F)?

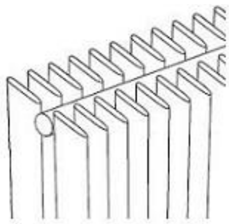
| $T_{outflow}$ [°C] (°F) | $T_{return}$ [°C] (°F) | Field of application |
|---|---|---|
| >140 (>284) | ≈100 ≈(212) | Urban networks: The very high outflow temperature allows high outflow/inflow ΔT values to be obtained. The primary circulation flow rates are thus reduced. The additional heating cost for the production of super-heated water (> 110 [°C] (230 °F)) and the need to install exchangers in the connected buildings is offset by gains in terms of the size of pipes and pumps. |
| 110 (230) | 70 (158) | Primary supply at medium power output (≈ 5 to 20 [MW]). The outflow temperature is at the regulation limit for Low Temperature Hot Water. The aim is to obtain outflow/inflow ΔT values as high as possible to decrease the supplied primary flow rate. The secondary supply can be fed by mixing cylinders (see section on cylinders). |
| 90 (194) | 70 (158) | Temperature regime used before 1990 to select radiators and convectors, i.e. a usual ΔT of 60 [K] between the emitter and the ambient air temperature. |
| 75 (167) | 65 (149) | The regime of 75/65 [°C] (167/149 °F) is today the standard calculation for radiator heating systems. It is also the testing regime used by manufacturers. Catalogues indicate heating output power for a ΔT of 50 [°C] (122 °F). Compared to 1980, the lowering of the usual heating regime from « 90/70 (194/158 °F) » to « 75/65 (167/149 °F) » has enabled part of the heat loss to be offset by maintaining a sufficient "emitter surface" which is useful to ensure good comfort levels. |
| 53 (127) | 47 (117) | Heat losses have today been significantly reduced. We can opt for low temperature radiators without having to install units which are too big. These temperature levels are very favourable for the operation of condensation boilers and for energy recovery (heat pumps, geothermal and solar heating, etc.) |
| 50 (122) | 40 (104) | Former under-floor heating |
| 45 (113) 40 (104) | 40 (104) 35 (95) | Today's under-floor heating |

# N°6 – Selection of hot water radiators training – A level

*Study the documentation below and complete the exercises.*



RX



RXD

| Reference | Collection | Power (W) | No. Of elements | Height mm (ins) | Length mm (ins) |
|---|---|---|---|---|---|
| **RX - Simple** | | ΔT of 50 [K] | | | |
| RX04-060-044 | Ready to install | 440 | 11 | 600 (23.6) | 440 (17.3) |
| RX04-060-064 | Ready to install | 640 | 16 | 600 (23.6) | 640 (25.2) |
| RX04-060-088 | Ready to install | 880 | 22 | 600 (23.6) | 880 (34.6) |
| RX04-060-112 | Ready to install | 1120 | 28 | 600 (23.6) | 1120 (44) |
| **RXD - Double** | | | | | |
| RXD04-060-056 | Ready to install | 1008 | 14 | 600 (23.6) | 560 (22) |
| RXD04-060-068 | Ready to install | 1224 | 17 | 600 (23.6) | 680 (26.8) |
| RXD04-060-084 | Ready to install | 1512 | 21 | 600 (23.6) | 840 (33) |
| RXD04-060-096 | Ready to install | 1728 | 24 | 600 (23.6) | 960 (37.8) |
| RXD04-060-112 | Ready to install | 2106 | 28 | 600 (23.6) | 1120 (44) |
| RXD04-060-136 | Ready to install | 2448 | 34 | 600 (23.6) | 1360 (53.5 |

Question 1

What differences are there between the RX and RXD models?

Question 2

Let's suppose that there is a RX model with the same output power as the RDX; what arguments could lead us to select one or the other mode?

Question 3

The manufacturer above indicates a heating output for what temperature difference between the radiator and the air?

Question 4

Is it possible to use this documentation for an installation with a temperature regime of 85/55 [°C] (185/131°F), and ambient heating temperature of 20 [°C] (68°F)?
Justify your answer.

Question 5

Is it possible to use this documentation for an installation with a water temperature?
Justify your answer.

Question 6

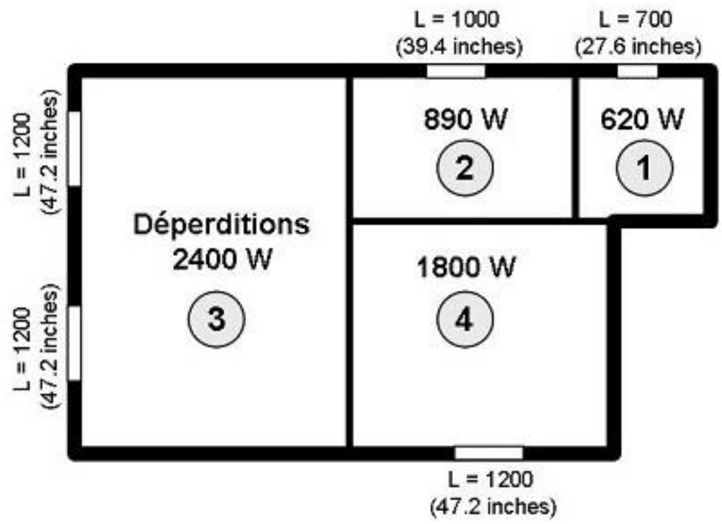
Is it possible to use this documentation for an installation with a water temperature regime of 70/60 [°C] (158/140°F) and an ambient heating temperature of 15 [°C] (59°F)?
Justify your answer.

Question 7

What is the logic used by the manufacturer Acova to establish the references of its RX04 and RXD04 radiators?

Question 8

In the ACOVARX RXD range, select the appropriate radiators for the house defined below.
*Don't worry about the cost of the installation and install the ideal number of radiators to obtain maximum comfort conditions.*
*The radiators will be mounted (under the window) when its width is greater than the radiator length.*
*We will not plan for additional power, other than that supplied by the radiator models available.*




| Room n° | Heat loss in [W] | Ref. of selected radiators | N° | P installed [W] | Additional power installed in % | Length in [mm] (ins) |
|---|---|---|---|---|---|---|
| 1 | 620 | RX04-060-064 | 1 | 640 W | + 3% | 640 (25.2ins) |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| Total | | | | | | |

*English lesson*
https://hvac-learning.com/heating/heat-emitters-and-boilers-training/selection-of-hot-water-emitters/

*French version:*
https://formation.xpair.com/cours/selection-emetteurs-eau-chaude.htm
https://formation.xpair.com/cours/emetteurs-de-demain.htm

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