

Guidelines for adapting Sundsvall Municipality's special- needs housing to ensure that risk groups are unharmed by heatwaves

Adopted by	Executive Committee
Date adopted	14 January 2019
Period of validity	Until further notice
Officer in charge	Head of Strategic Community Development Department, CEO's Staff
Ref. no.	KS-2018-00768
Target groups	Social Services Committee Drakfastigheter (Property Administration)

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1. Introduction

These *Guidelines for adapting Sundsvall Municipality's special-needs housing to ensure that risk groups are unharmed by heatwaves* were developed in the EU CLIMATE project with support from the EU (the Interreg Programme for the Northern Periphery and Arctic, NPA) and by Region Västernorrland and Sundsvall Municipality.

2. Background

As a consequence of climate change, heatwaves are expected to become more intense, frequent and lasting in the future. Historically, a heatwave has occurred about once a year in south-eastern Norrland, and more extreme heatwaves have taken place, on average, once every 20 years. By the end of this century, extreme heatwaves are expected to occur every three to five years.

Swedish society is not adapted to handle high temperatures to the same extent as, for example, countries in southern Europe. Homes and commercial premises often lack cooling facilities and outdoor areas are rarely designed to provide shade. On the contrary, sunshine and extensive light penetration are often higher priorities.

At present, long periods of high temperatures are relatively unusual in Sweden. Many Swedes are therefore comparatively unaccustomed to interpreting the body's signals when it is overheated, and have inadequate knowledge of the appropriate action to take in the event of high outdoor temperatures.

Important preconditions for risk reduction, especially for vulnerable groups in the community, are for municipal premises to be equipped and prepared for heatwaves and new premises planned for a warmer climate than we currently have in Västernorrland.

3. Purpose

The purpose of these *Guidelines* is to define the level of physical steps required in Sundsvall Municipality's special-needs housing to combat overheating due to heatwaves among individuals in heatwave risk groups.

4. What is a heatwave?

There is no internationally accepted definition of what constitutes a heatwave. In Sweden, we have adapted to a relatively cold climate and, accordingly, temperatures perceived as normal in many countries may pose substantial risks here.

The Swedish Meteorological and Hydrological Institute (SMHI) defines a heatwave as a period of five consecutive days with a temperature above 25° Celsius. For SMHI to issue a

high-temperature warning, there must be a forecast of three days or more in succession with a temperature of at least 26°. A Class 1 warning of very high temperatures requires temperatures of at least 30° to be forecast for three days or more. A Class 2 warning of extremely high temperatures is issued if the forecast is 33° or more for at least three days, or at least 30° for five days or more.

5. Heatwave risk groups

Persistent heat can lead to heat stress and cause dehydration, which affects the cardiovascular system and kidneys. Older people are particularly sensitive to high temperatures since they may have a reduced ability to feel thirst and, with age, bodily changes occur that impair their ability to regulate body temperature (thermoregulation) and fluid balance.

Babies and young children are also particularly sensitive to heat because their capacity for thermoregulation is not yet fully developed. Additional factors that exacerbate risks of health problems in heatwaves are many common diseases and ingestion of certain medicines.

The Public Health Agency of Sweden emphasises that high temperatures pose particularly high risks for the following groups:

- older people
- people with chronic diseases
- people with disabilities
- small children and pregnant women
- people on medication.

With the exception of the ‘small children and pregnant women’ category, Sundsvall Municipality provides special-needs housing for people in all the above high-risk groups. Some live in apartments in the ordinary housing stock, but most reside in one of the Municipality’s housing units for the following categories of people with special needs:

- older people (1,130 residents)
- people with disabilities (262 resident ‘LSS clients’, ‘LSS’ being the acronym for *Lagen om support och service till vissa funktionshindrade*, the Swedish Act concerning Support and Service for Persons with Certain Functional Impairments)
- social-psychiatric clients (29).

These *Guidelines* concern those forms of special-needs housing that are specifically intended for categories belonging to heatwave risk groups: older people, LSS clients and social-psychiatric clients.

6. Outdoor environment

South-facing windows can be a good way to let abundant natural light into a building, especially in winter when there is little daylight. However, the same windows have the

disadvantage that, without suitable shading from the sun, they may result in high indoor temperatures in summer.

In Sundsvall Municipality's local programme of special-needs housing for older people, devices that shelter windows from solar and heat radiation are highlighted as technical features that must be present on all buildings after conversion, extension and new construction. To supplement artificial means of shading, trees and bushes provide natural shelter from the sun in summer, while allowing daylight through during the darker months of the year. Plants can also be used to shade sun-exposed walls and thus contribute to a lower indoor temperature.

Today, trees and bushes are commonly removed to give more daylight, improved security and better views. Through strategically well-planned design of the outdoor environment, shrubs and trees can instead be a simple, inexpensive and aesthetically pleasing means of combating high indoor temperatures. Increased vegetation can also bring many other benefits, such as better air quality, less noise and increased biodiversity.

To get the desired effect and shading at the right time of day, it is important to investigate where the trees or bushes should be placed and how tall they should be. The choice of vegetation will affect the amount of daylight entering the building. A broad-leaved tree with an extensive canopy, for example can provide compact shade for much of the day, while a pine tree gives sparser shade for a shorter time. If the tree is to be close to the building and affect the view, it is advantageous to choose a flowering tree that has fine autumn colours.

For Drakfastigheter's needs analysis, performed when conversion, extension and new construction take place, there must be a checklist of possible outdoor actions that could be taken to combat high indoor temperatures. A clear checklist is a good way to ensure that appropriate measures are taken in an early phase of an ongoing project.

7. Ten guidelines for action against overheating in municipal special-needs housing

1. In the landscaping of the external environment, scope for natural shading of the property by means of vegetation must be taken into account.
2. Shading from the sun must be provided on patios and terraces so that residents can sit outdoors in the shade.
3. Every window exposed to the sun should have some form of external shading device, such as an awning, to reduce incoming thermal radiation.
4. Every property must have 'night cooling' facilities or corresponding means of cooling the premises at the coolest time in the 24 hours.
5. Air intakes for ventilation must be positioned on the shady side of the building or in another suitable place to avoid intake of warm air.

6. In conversion and new construction, if possible, a suitable heating, ventilation and air-conditioning (HVAC) system for the entire property must be installed. Alternatively, scope for retrofitting of HVAC equipment must be ensured. In terms of the site location and design planning of the building, the risk of high indoor temperatures must also be taken into account. Bedrooms and large window sections on the south-facing side should, for example, be avoided.
7. Cooling to a temperature of 25° Celsius for at least one large communal room or equivalent in each unit and/or section of the property must be achievable during heatwaves. Where it has been found to be required for a particular building used for special-needs housing, there must also be access to areas cooled by ceiling fans or similar devices that can help to provide relief for the residents in hot weather.
8. Temperatures can vary greatly from one room to another in the properties. There must therefore be a thermometer or corresponding equipment to allow measurement of temperature in every special-needs housing property. If further measurements have been found to be required, the number of temperature displays in existing HVAC systems must be increased.
9. Scope for remedial action must be investigated for rooms that have been found particularly prone to overheating. To survey any rooms or sections where high temperatures are especially liable to occur, temperature statistics concerning the premises from periods of high outdoor temperatures should be analysed.
10. As far as possible, all action taken and equipment installed should be in the form of fixed installations that require no manual adjustment by staff at the housing units. However, every unit must have a locally adapted information sheet concerning any possible manual handling of, for example, ventilation systems or equipment for solar shading. The information must include contact details for the person in charge of the property, who must be available to provide help by answering questions.

8. Costs

In Sundsvall Municipality, there are a total of 64 housing units for people with special needs: 26 for older people, 35 for LSS and 3 for social-psychiatric clients. Of these, inventories have been drawn up for 21 units for older people and 18 for LSS clients (see Appendix 1).

The resulting inventories have been used to estimate the cost of applying these *Guidelines* in all 64 of the units. The cost estimates have been made according to a standardised template. If the *Guidelines* are actually implemented in a particular property, site-specific conditions may require solutions other than those on which the estimates are based. The true cost may therefore be either higher or lower than the estimates below.

The investment cost of fulfilling the *Guidelines* in all 64 units has been assessed, on the basis of the inventories, as **approximately SEK 9 million** (roughly SEK 140,000 per unit or SEK 6,500 per individual place in a special-needs housing unit). In addition to this investment

cost, there will be an increased annual operating cost for cooling of the premises, which will vary from one year to the next depending on such factors as weather and electricity prices.

Costs are distributed as follows.

8.1 Cooling requirements

As of today, only one of the housing units where inventories were carried out has installed cooling for the entire property. During the inventory process, the number of portable cooling systems required to cool an existing communal room at each unit, and what purchasing the cooling systems would cost, were investigated. However, requirements for cooling different units vary, and the best technical solution may therefore also differ among them.

In most housing, fixed installations in the form of air heat pumps are probably preferable to portable systems. A fixed installation may involve a slightly higher investment cost than that of portable systems but, instead, requires fewer appliances and has a lower operating cost as well as providing the option of booster heating in periods of extreme winter cold. Low-energy use, resulting in reduced environmental impact and operating costs, should always be given high priority when the system type is chosen.

To ensure limited use of energy and thereby relatively low environmental impact and operating cost, it is important that stationary systems can be regulated by the property manager, or centrally at Drakfastigheter. The purpose of the cooling systems is not general comfort cooling, but to ensure access to an acceptable indoor temperature (max. 25°) during extreme weather when other heat-reducing measures are insufficient. If the systems can be regulated on site at the housing units, the risk is that they will be used for considerably longer periods, and high operating costs may result.

According to the inventories, the estimated average purchase cost of cooling systems at the housing units covered by the inventories is SEK 71,000 for the older people's units and SEK 17,500 for those accommodating LSS and social-psychiatric clients. Based on these figures, the cost of implementing cooling in all the housing units covered by these *Guidelines* is estimated at **some SEK 2.5 million**. Besides the purchase cost, there is a variable operating cost for cooling that is dependent on the degree of use and the electricity price. If all the housing units affected had portable cooling systems and these, for example, were run at maximum power around the clock for a week at the current electricity price (SEK 1 per kWh), the cost would be about SEK 30,000.

8.2 Fans

Although fans cannot lower the temperature, they can have a cooling effect on people and reduce heat discomfort. Around half of the housing units where inventories have been drawn up already have a satisfactory number of fans. The estimated cost of purchasing floor fans so that each unit has them for one communal room is **some SEK 150,000**. To avoid loose items that may get in the way and pose a risk in some units, fixed ceiling fans should be installed first. This may involve a higher investment cost than that estimated for floor fans.

8.3 Shading for windows

External solar shading in the form of awnings or the like can cause a substantial, energy-efficient reduction in indoor temperature. Today, very few of the housing units where inventories have been done have external solar shading. Installing awnings on all sun-exposed windows in every unit covered by these *Guidelines* would, it is estimated, cost **approximately SEK 6.1 million**. Depending on site-specific circumstances, awnings are not always the best solution; other options may cost more or less, depending on the devices used.

8.4 Temperature gauges

One requirement for knowing when the indoor temperature reaches dangerous levels is to have proper temperature-measuring equipment. The cost of equipping all the housing units covered in these *Guidelines* with manual thermometers is estimated at **approximately SEK 130,000**. Essentially, however, all the units have ventilation systems that can measure temperature in selected rooms. If this measurement process is considered satisfactory, no further equipment is required. If there is a need to measure the temperature in one or a few more rooms, the system can first of all be supplemented with more temperature gauges. In the event of further needs, manual temperature measurement may be required.

8.5 Air intakes

Outdoor air for ventilation should be obtained in suitable places. Temperature is one factor to consider, and the intakes should therefore be positioned on the shaded side of the building or equivalent. Of the 39 housing units where inventories were carried out, only 2 had air intakes that were deemed to be in inappropriate positions. The estimated cost of relocating the intakes on the premises of the two units concerned is **approximately SEK 150,000**.

8.6 Shading for patios and terraces

Only a few of the terraces and patios at the units where inventories have been carried out have inadequate shelter from the sun. The cost of ensuring that all units subject to these *Guidelines* have satisfactory shelter from the sun for their outdoor seating areas is estimated at **approximately SEK 80,000**.

9. Conclusions

With Sundsvall's present-day climate, there is already a need for measures to reduce the risk of personal injury, due to high indoor temperatures at the Municipality's housing units for people with special needs who are at particular risk during heatwaves. In the decades ahead, the risk of harmful consequences will be ever greater as the climate becomes warmer, bringing higher maximum temperatures and more frequently recurring heatwaves. Early preventive action will lessen not only suffering for many individuals, but also the need for costly measures at an acute stage.

Preventive measures in the form of a well-planned outdoor environment, with vegetation that can shade the building from the sun, and also technical solutions in the form of awnings or corresponding means of shading, reduce the need for costly, energy-intensive cooling. However, when it is hot outside, the indoor temperature will always approach that of the exterior unless cooling takes place. One reason for this is that the ventilation system must be kept on during the day, which eventually heats up the building to the same temperature as outdoors. Keeping the interior below the outdoor temperature therefore requires some kind of cooling unit. Not only is the cost of installing these systems high, but they also boost energy use and, accordingly, environmental impact and operating costs.

To reduce energy use as far as possible, cooling facilities should be installed only after other measures — of the kind that do not boost energy use by affecting the HVAC system's operating status — have been taken. Limiting the cooling, first of all, to communal areas and to a temperature of 25° reduces energy use appreciably compared with cooling the entire building to 23°, which is the normal indoor temperature at the housing units. Such limitations in terms of floor space and temperature are ways of reducing energy use, environmental impact and operating costs, while providing a relatively cool environment for both residents and staff at the hottest time of day.

Drakfastigheter, which owns and manages most of the units concerned, is responsible for ensuring that the *Guidelines* are followed, and for operating and maintaining the equipment. To date, the Sundsvall social services have borne responsibility for external shelter from the sun, such as awnings, but in the future Drakfastigheter will be responsible for these as well.

Until all Sundsvall Municipality's special-needs housing meets the standards laid down in these *Guidelines*, Drakfastigheter must monitor how far such premises comply with the *Guidelines* and report this to the Executive Committee once during every Committee term of office.

10. Appendices

10.1 Estimated costs of applying the *Guidelines* in selected special-needs housing

Housing units for older people	HVAC	Fans	Awnings etc.	Night cooling	Thermometers	Air intakes	Patio/terrace	Airing	Total cost
Alnösol	60,000	-	60,000	Yes	2,000	OK	OK	Yes	122,000
Ljustagården	60,000	10,000	240,000	Unknown	4,000	OK	OK	No	314,000
Alnö servicehus	45,000	4,000	115,000	Yes	1,000	OK	OK	Yes	165,000
Lindgården	-	-	525,000	Yes	18,000	OK	OK	Partly	543,000
Hellbergsgården	45,000	-	65,000	Yes	3,000	OK	OK	No	113,000
Solhaga	165,000	-	220,000	Yes	7,000	OK	OK	No	392,000
Granbacken	75,000	2,000	120,000	Yes	3,000	OK	OK	Yes	200,000
Granlunda	120,000	4,000	145,000	Yes	4,000	OK	OK	Yes	273,000
Solgården	105,000	14,000	255,000	Yes	3,000	OK	18,750	No	395,750
Rutsgården	15,000	-	140,000	Yes	2,000	OK	OK	No	157,000
Knutsgården service housing	30,000	4,000	300,000	Yes	1,000	OK	8,500	Yes	343,500
Knutshemmet	60,000	-	150,000	Yes	2,000	OK	OK	Yes	212,000
Skogsbrynet	30,000	4,000	75,000	Yes	2,000	OK	OK	No	111,000
Attmarhem	60,000	6,000	190,000	Mostly mechanical exhaust air	2,000	OK	16,000	Yes	274,000
Tunastrand	60,000	4,000	105,000	Yes	2,000	OK	OK	Yes	171,000
Thulegården	45,000	-	110,000	Yes	2,000	50,000	OK	No	207,000
Skottsundbacken 1, 2, 7 and 8	240,000	10,000	640,000	Yes	5,000	OK	OK	No	895,000
Skottsundbacken 3, 4, 5 and 6 (included in 1, 2, 7 and 8)									
Tingsta	75,000	10,000	200,000	Yes	5,000	OK	OK	No	290,000
Havssundet	45,000	-	90,000	Yes	3,000	OK	8,000	Yes	146,000
Almedalen	45,000	6,000	55,000	Yes	3,000	OK	OK	No	109,000
Norra Kajen	120,000	16,000	-	Yes	4,000	OK	OK	No	140,000
Total	1,500,000	94,000	3,800,000		78,000	50,000	51,250		5,573,250
Average	71,500	4,500	181,000		3,700	2,400	2,400		265,500

SEK 265,500 x 26 homes for older people = SEK 6,903,000 altogether

Housing units for LSS clients	HVAC	Fans	Awnings etc.	Night cooling	Thermometers	Air intakes	Patio/terrace	Airing	Total cost
Januarivägen 86	60,000	2,000	35,000	Yes	1,000	OK	OK	No	53,000
Januarivägen 80	60,000	2,000	170,000	Yes	1,000	OK	OK	No	188,000
Skraulingsvägen	45,000	2,000	25,000	Yes	1,000	100,000	OK	No	143,000
Bogserarvägen 21	-	-	-	Yes	1,000	OK	OK	Yes	16,000
Bäckebovägen 51	45,000	-	35,000	Yes	1,000	OK	OK	Yes	51,000
Bölevägen 18	165,000	2,000	40,000	Yes	1,000	OK	OK	Yes	58,000
Järviksvägen 2 (Hovid)	75,000	-	20,000	Yes	1,000	OK	OK	No	36,000
Knektbacken	120,000	-	25,000	Yes	1,000	OK	OK	No	56,000
Kryssarvägen 84	105,000	2,000	50,000	Yes	1,000	OK	OK	No	68,000
Lindköpingsvägen 2	15,000	-	40,000	Yes	1,000	OK	OK	Yes	56,000
Luftvärnsvägen 7	30,000	2,000	20,000	Yes	1,000	OK	2,000	Yes	40,000
Skanoörvägen 2 B	60,000	2,000	40,000	Yes	1,000	OK	OK	No	58,000
Bruksgatan 22	30,000	-	40,000	Yes	1,000	OK	OK	Yes	71,000
Kuskvägen 12	60,000	-	10,000	Yes	1,000	OK	OK	Yes	41,000
Sönderborgsgatan	60,000	-	35,000	Yes	1,000	OK	10,000	No	61,000
Uttervägen 1A	45,000	-	25,000	Yes	1,000	OK	OK	Yes	41,000
Åstavägen	240,000	-	-	Yes	1,000	OK	OK	Yes	16,000
Ängebo 51	-	-	35,000	Yes	1,000	OK	OK	Yes	51,000
Total	1,500,000	14,000	645,000		18,000	100,000	12,000		1,104,000
Average	71,500	1,000	36,000		1,000	5,500	500		61,000

SEK 61,000 x (35 homes for LSS clients + 3 for social-psychiatric clients) = SEK 2,318,000. (The cost of special-needs housing in social psychiatry is estimated as comparable to that in LSS care provision.)