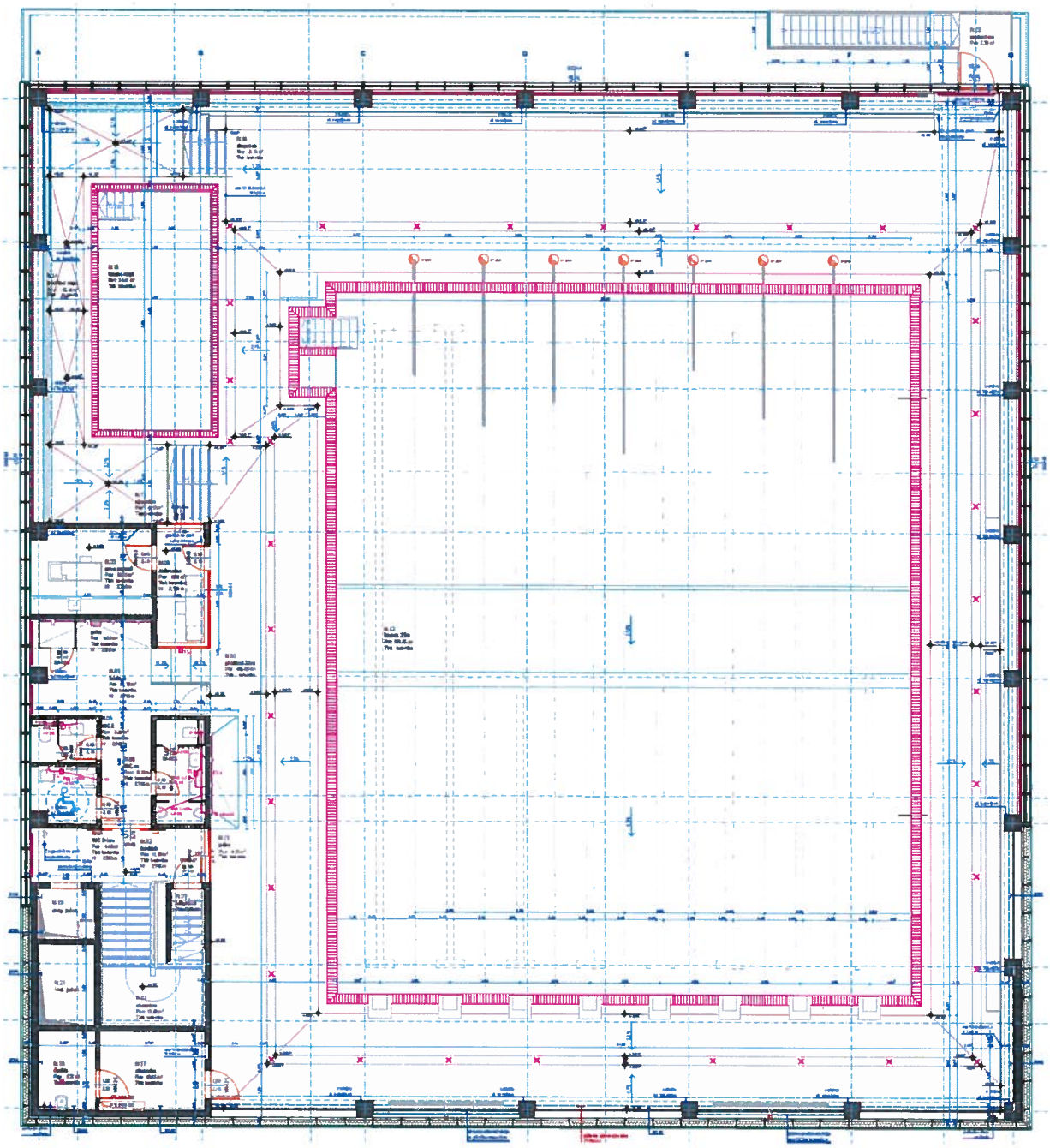
datum:	24. 7. 2019
naročnik:	**Mestna občina Nova Gorica** **Trg Edvarda Kardelja 1** **5000 Nova Gorica**
projekt:	**POROČILO** **o energetskih ocenah in vrednotenju karakteristik za načrtovani sNES Zimski bazen MO Nova Gorica, faza PZI** (poročilo s prilogami za sofinancerja)
delovni nalog:	DN 2006647
naročilo:	pog. št. 351-73/2014-192 z dne 30. 5. 2019
center:	**CENTER ZA BIVALNO OKOLJE, GRADBENO FIZIKO IN ENERGIJO**
nosilec naloge:	**Dr. Miha PRAZNIK**, univ. dipl. inž. str.
vodja centra:	**Dr. Marjana ŠIJANEC ZAVRL**, univ. dipl. inž. grad.
v.d. direktorja:	**Marijan PREŠEREN**, univ. dipl. inž. grad.

GRADBENI INŠTITUT ZRMK d.o.o
Ljubljana, Dimičeva 12

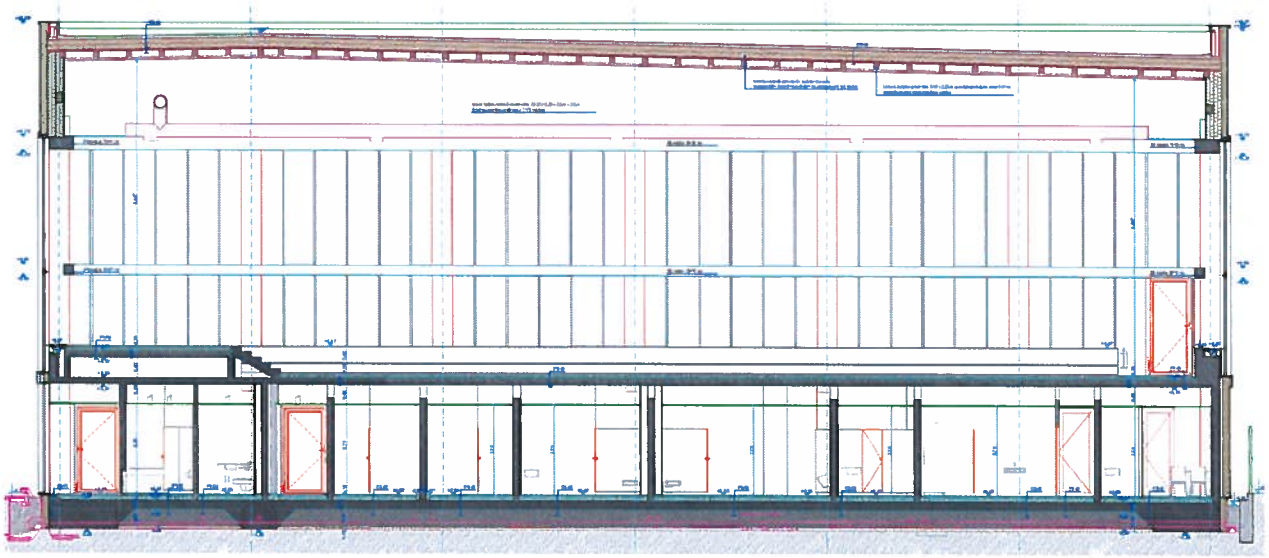
VSEBINA

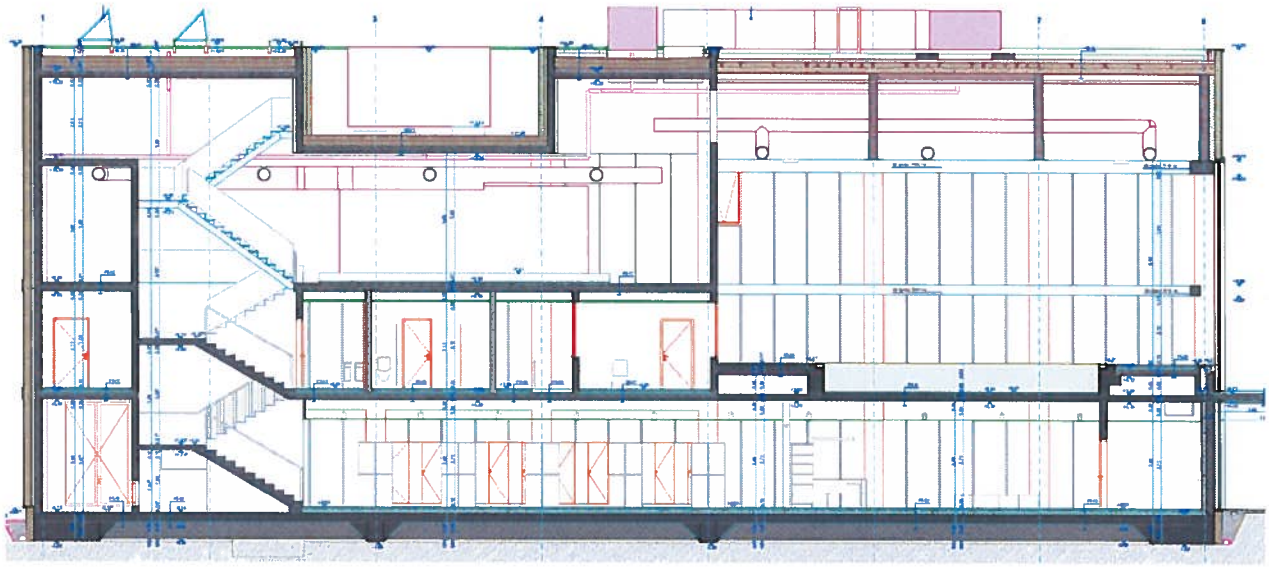
1. POVZETEK

Kočno poročilo o izvedbi naloge se nanaša na opis koncepta in izvedbenih projektnih rešitev za novo javno stavbo splošnega družbenega pomena. Investitor z oblikovanimi izvedbenimi rešitvami kandidira za pridobitev finančnih spodbud na javnem pozivu Eko sklada j.s., 56SUB-LSRS17, za sofinanciranje gradnje novih javnih skoraj nič-energijskih stavb v razredu novogradenj, ki so toplotno izolirane pretežno z materiali mineralnega izvora.



Tloris nadstropja





Prerez čez bazenski del ter prerez čez več-etažni del

Projekt novogradnje je bil preverjen v fazi PZI. Na podlagi ugotovitev so bile izvedene izboljšave na energetskih rešitvah, najbolj obsežne so bile prilagoditve na toplotnem ovoju z intervencijami na strani toplotno izolacijskih materialov.

Za potrebe te naloge se računsko obravnava novogradnja kot skoraj nič-energijska javna stavba, torej ne kot tehnološki objekt (izvzet je vpliv bazenskih tehnologij). Stavba obratuje samo v zimskem obdobju, zato je brezpredmetna računska raba energije iz računske metodologije, ki je povezana s poletjem.

Glede na detajlirane rešitve v toplotnem ovoju in na ostalih energetskih temah se novelira vrednotenje energijske učinkovitosti objekta ter se izdelujejo ostale spremljajoče preverbe. Poleg navedenega se podaja tudi naslednje ugotovitve v zvezi z izpolnjevanjem kriterijev iz razpisa Eko sklada:

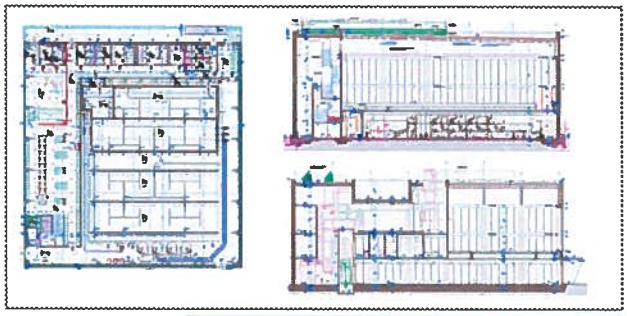
- Toplotna prehodnost neprosojnih delov toplotnega ovoja stavb sme znašati $U \leq 0{,}15$ W/m^{2}K. Ta kriterij je ob upoštevanju potrjenih izboljšav izpolnjen za vseh 17 tipičnih sklopih zunanjega toplotnega ovoja stavbe, pri katerih se vrednosti gibljejo med 0,07 in 0,15 W/m^{2}K.

- Glede na strukturo sklopov toplotnega ovoja v fazi PZI je v njem uporabljenih 85,2% mineralnih izolacij, s čimer novogradnja kandidira v mineralnem razredu.
- Energijska učinkovitost stavbe, izračunana po metodi PHPP, mora znašati $Q_h \leq 6$ kWh/m^{3}a, ta kriterij je izpolnjen z evidentirano vrednostjo 5,0 kWh/m^{3}a in torej zadostno rezervo v učinkovitosti, ki nastopa primarno kot posledica kompaktnosti in energetskih značilnosti stavbe, optimirane toplotne zaščite ovoja stavbe in prilagojenega zunanjega stavbnega pohištva. Naveden rezultat je seveda tudi posledica ostalih vplivnih dejavnikov, kot so npr. učinkovit sistem centralnega prezračevanja, visoka zrakotesnost stavbe, itd.
- Obvezna je vgradnja zunanjega stavbnega pohištva s trojno zasteklitvijo, s toplotno prehodnostjo $U \leq 0{,}9$ W/m^{2}K. Ta kriterij je glede na zahteve iz faze PZI in predvidene karakteristike stavbnega pohištva izpolnjen za steklene fasade in okna ter vrata. Pri požarnih in evakuacijskih vratih pa je zaradi posebnih tehničnih zahtev dovoljena vrednost elementov $U \leq 1{,}1$ W/m^{2}K.
- Vgrajen mora biti energijsko učinkovit sistem prezračevanja prostorov z vračanjem toplote odpadnega zraka, pri katerem mora biti skupni izkoristek rekuperacije vsaj 80% pri ocenjenih obratovalnih pogojih. Projektant strojnih instalacij je v PZI fazi z izborom dveh tehnologij za prezračevanje in spremljajočimi izračuni izkazal vračanje toplote v območju temperaturnega izkoristka malo nad 80%.
- Stavba mora najmanj 50% letne dovedene energije za delovanje stavbe pokriti iz obnovljivih virov energije. Za ogrevanje prostorov se predvideva pretežna uporaba toplotne črpalke tipa zrak-voda in toplote iz daljinskega sistema ogrevanja (DOLB). Priprava tople sanitarne vode pa je v celoti pokrita iz termičnega solarnega sistema na strehi stavbe in izkoriščanja toplote odpadne vode. Po projektantski oceni in posledičnem izračunu se izkazuje tudi kriterij rabe OVE kot izpolnjen, z vrednostjo 74%.
- Po izvedbi novogradnje mora biti s testom zrakotesnosti izmerjena vrednost za obodne konstrukcije v razredu $n_{50} \leq 0{,}6$ h^{-1}. Izpolnjevanje tega kriterija morajo v sodelovanju zagotoviti načrtovalci stavbe, ponudniki gradbenih proizvodov ter izvajalci. V izračunih učinkovitosti novogradnje je v tej fazi uporabljena zgornja mejna vrednost $n_{50} \leq 0{,}6$ h^{-1}.
- Za dodelitev spodbude so identificirani naslednji ključni podatki. Znotraj toplotnega ovoja stavba se nahaja po popisu prostorov in oceni skupno 2.390,19 m^2 površin. Neto prostornina (zraka) znotraj toplotnega ovoja znaša približno 14.257,37 m^3. V stavbnem ovoju je vgrajeno zunanje stavbno pohištvo v Alu izvedbi profilov.

2. UVOD

Predmet strokovne storitve je računska energetska presoja projektantskih rešitev za novogradnjo, iz faze PZI, s ciljno prilagojenim izborom izvedbenih rešitev za doseganje sofinanciranja novogradnje, ki je toplotno zaščitena z izolacijskimi materiali pretežno mineralnega izvora. Računska presoja je izvedena skladno s tozadevno prakso sofinancerja, za energetsko evaluacijo projekta ter potrebnih izboljšav projektnih rešitev, v sklopu kandidiranja za sofinanciranje sNES javne novogradnje pri Eko skladu. Izračuni in njihovi rezultati so torej ciljno prilagojeni za samo naročilo storitve ter se ne uporabljajo v druge namene, npr. za certificiranje pasivne stavbe, kot podpora projektiranju instalacij, itd.

PHPP-Energy balance calculation



Building:	Plavalni zimski bazen		
Street:	parc.št. 555, 554/4, 632/16 in 632/22 k.o. Nova Gorica		
Postcode/City:	5000	Nova Gorica	
Province/Country:	Slovenija		SI-Slovenia
Building type:	Športni objekt		
Climate data set:	ud---01-Ljubljana - referenčno		
Climate zone:	3: Cool-temperate	Altitude of location:	309 m
Home owner / Client:	Mestna občina Nova Gorica		
Street:	Trg Edvarda Kardelja 1		
Postcode/City:	5000	Nova Gorica	
Province/Country:	Slovenija		SI-Slovenia

Architecture:	Projekt d.d.		
Street:	Kidričeva ulica 9a		
Postcode/City:	5000	Nova Gorica	
Province/Country:	Slovenija		SI-Slovenia
Energy consultancy:	dr. Miha Praznik, Gradbeni inštitut ZRMK d.o.o.		
Street:	Dimičeva 12		
Postcode/City:	1000	Ljubljana	
Province/Country:	Slovenija		SI-Slovenia
Mechanical engineer:	MM-BIRO d.o.o.		
Street:	Tolminskih puntarjev 4		
Postcode/City:	5000	Nova Gorica	
Province/Country:	Slovenija		SI-Slovenia
Certification:			
Street:			
Postcode/City:			
Province/Country:			

Year of construction:	2020	Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,8	IHG cooling case [W/m²]	2,8
No. of occupants:	150,0	Specific capacity [Wh/K per m² TFA]:	204	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	2390,2				
Space heating	Heating demand kWh/(m²a)	29,6	≤	-	-	no
	kWh/(m³a)	5,0	≤	6,0		
	Heating load W/m²	18	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	1	≤	-	-	-
	Cooling load W/m²	7	≤	-	-	
	Frequency of overheating (> 25 °C) %	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	-		-
Airtightness	Pressurization test result n_{50} 1/h	0,6	≤	-		-
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	87	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	104	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	6	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

Izračun je izveden po metodologiji PHPP V9, angleška verzija, na podlagi usklajenih izvedbenih rešitev za toplotno zaščito zunanjega ovoja stavbe ter predpostavk za ostale izbrane tehnologije in segmente. Pri vrednotenju učinkovitosti projektnih rešitev za zagotavljanje višje energetske učinkovitosti stavbe smo v izračunu uporabili podatke iz posredovane projektne dokumentacije in ostale podatke projektantov o izbranih primerih ustreznih materialov, njihovih gradbeno fizikalnih lastnostih v sestavah (npr. toplotne

prevodnosti materialov, stavbnega pohištva itd., ipd.), ter druge energetske ocene primerov ustreznih sistemov in tehnologij po predlogu projektanta strojnih inštalacij. Za potrebe te naloge se računsko obravnava novogradnja kot skoraj nič-energijska javna stavba, torej ne kot tehnološki objekt (izvzet je vpliv bazenskih tehnologij). Stavba obratuje samo v zimskem obdobju, zato je brezpredmetna računska raba energije iz računske metodologije, ki je povezana s poletjem.

3. IZPOLNJEVANJE ZAHTEV JAVNEGA POZIVA

V fazi priprave izvedbenih načrtov arhitekture in strojnih instalacij za novogradnjo, za oddajo dokumentacije za sofinanciranje novogradnje po javnem pozivu Eko sklada, je bilo potrebno zagotoviti izpolnjevanje več razpisanih kriterijev. Ti se nanašajo na karakteristike toplotnega ovoja stavbe in sistemov v njej.

3.1. TOPLOTNA ZAŠČITA NEPROSOJNIH ELEMENTOV TOPLOTNEGA OVOJA

Toplotna prehodnost neprosojnih elementov toplotnega ovoja se zagotavlja in po potrebi izboljšuje s ciljem doseganja vrednosti U $\leq$ 0,15 W/m^{2}K (opisi sestav in izračuni so v nadaljevanju poročila):

Passive House Components — Energy balance calculation with PHPP Version 9.6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m

Go to: 'AREAS' — www.passivehouse.com/component-database
Thermal bridges (Psi-values) — Ventilation units
Glazing — Compact units
Window frames — Heat recovery DHW

Building assemblies (U-Values)

Recommended starting values for optimisation: U-values for walls and roofs | Floor slabs: 0,15 W/(m²K) | 0,31 W/(m²K)

		1			
ID	Building system	Building assembly	Total thickness	U-Value	Interior insulation
	Summary of the constructions calculated in 'U values' worksheet		m	W/(m²K)	-
01ud	PS-01 tla na terenu	PS-01 tla na terenu	0,960	0,111	0
02ud	PS-02 tla na terenu	PS-02 tla na terenu	0,980	0,111	0
03ud	PS-03 tla na terenu	PS-03 tla na terenu	0,980	0,111	0
04ud	PS-04 tla na terenu	PS-04 tla na terenu	0,800	0,153	0
05ud	PS-05 tla na terenu	PS-05 tla na terenu	0,800	0,153	0
06ud	PS-06 tla na terenu	PS-06 tla na terenu	0,801	0,152	0
07ud	KR-01 ravna AB streha s prodcem	KR-01 ravna AB streha s prodcem	0,700	0,108	0
08ud	KR-02 ravna AB streha z AB ploščami	KR-02 ravna AB streha z AB ploščami	0,900	0,107	0
09ud	KR-03 ravna AB streha s folijo	KR-03 ravna AB streha s folijo	0,633	0,109	0
10ud	KR-04 poševni del strehe	KR-04 poševni del strehe	0,735	0,080	0
11ud	CO-01-02-03 cokl in izolacija temelja	CO-01-02-03 cokl in izolacija temelja	0,480	0,152	0
12ud	ZO-03-04-05-08 zunanja AB stena s fasadnim	ZO-03-04-05-08 zunanja AB stena s fasadnim	0,555	0,143	0
13ud	ZO-07 fasadni panel z notranjo oblogo	ZO-07 fasadni panel z notranjo oblogo	0,610	0,140	0
14ud	ZO-09 fasadni panel	ZO-09 fasadni panel	0,250	0,149	0
15ud	ZO-10 zunanja AB stena z izolacijo	ZO-10 zunanja AB stena z izolacijo	0,520	0,148	0
16ud	ZO-12 ostrešje V-Z	ZO-12 ostrešje V-Z	0,657	0,068	0
17ud	ZO-13 ostrešje S-J	ZO-13 ostrešje S-J	0,652	0,089	0
18ud			0,657	0,128	0

Toplotne prehodnosti neprosojnih elementov po izboljšavah sestav

Toplotne prehodnosti elementov, ki so izpostavljeni ter mejijo npr. na zunanji zrak, se gibljejo v območju zahtevanih nižjih vrednosti. Pri sklopih z zmanjšanimi transmisijskimi toplotnimi izgubami, ker npr. mejijo na teren, so prav tako izbrani sistemi toplotne zaščite s toplotno prehodnostjo do izpostavljene mejne vrednosti.

3.2. ZUNANJE STAVBNO POHIŠTVO

Obvezna je vgradnja zunanjega stavbnega pohištva s trojno zasteklitvijo, s toplotno prehodnostjo znotraj mejne vrednosti $U \leq 0{,}9$ W/m^{2}K:

- Predvidena je vgradnja zunanjega stavbnega pohištva tj. steklenih fasad, oken in zastekljenih vrat z Alu profili. Za izpolnjevanje kriterija razpisovalca je projektant predložil dokazila, iz katerih so razvidni rezultati izračunov stavbnega pohištva, skladno s tozadevnim standardom. Glede na zahteve projektanta je potrebno izbirati naslednje energijske karakteristike komponent: toplotna prehodnost profilov za panele giblje v povprečju med U_f = 0,81 in 0,99 W/m^{2}K, v kombinaciji z zasteklitvijo s toplotno prehodnostjo U_g = 0,50 W/m^{2}K. Ker velike steklene površine nimajo zunanjih senčil je na njih predvidena uporaba sončno zaščitnih stekel s solarnimi dotoki g = 22% ter toplotno prevodnostjo distančnika Ψ = 0,07 W/mK. Skupna toplotna prehodnost elementov, ob upoštevanju predhodnih zahtev, po izračunih in dokazilih za elemente rezultira v vrednosti $U_w \leq 0{,}90$ W/m^{2}K, kar sovpada za zahtevo sofinancerja.
- Pri vratih je dosežena vrednost toplotne prehodnosti nižja od mejne vrednosti $U_D \leq 0{,}9$ W/m^{2}K. Pri evakuacijskih vratih za tehnične prostore, kjer gre za elemente s posebnimi tehničnimi zahtevami, je predviden izbor elementov s prehodnostjo $U \leq 1{,}1$ W/m^{2}K, kar je sprejemljivo po tolmačenju sofinancerja.

3.3. ENERGIJSKO UČINKOVITO PREZRAČEVANJE IN KONDICIONIRANJE PROSTOROV

Glede na zahteve razpisovalca mora biti vgrajen energijsko učinkovit sistem prezračevanja prostorov, z vračanjem toplote odpadnega zraka vsaj 80%, pri normalnih obratovalnih pogojih.

V PZI načrtih prezračevanja novogradnje mora biti razvidno energijsko učinkovito prezračevanje, kot je navedeno predhodno, za vse prostore v toplotnem ovoju stavbe. Pri tem so lahko posamezni prostori v dovodnih, pretočnih ali odvodnih conah zraka ali pa v njihovi kombinaciji.

Prostori novogradnje so v največjem obsegu kondicionirani, kar pomeni da so poleg ustrezne oskrbe z zrakom tudi centralno ogrevani. Ključni prostori se lahko tudi pohlajujejo z aktivnimi in pasivnimi sistemi.

Za prezračevanje bazenskega dela in ostalih prostorov je predvidenih več tehnologij. Vračanje toplote je pri dveh napravah v vrednosti najmanj 80,2% in 80,4% 88,3%, kar izhaja iz izračunov za sezonske robne pogoje in dokazil za same naprave. Naprave izkoriščajo odpadno toploto prezračevanja s toplotno črpalko.

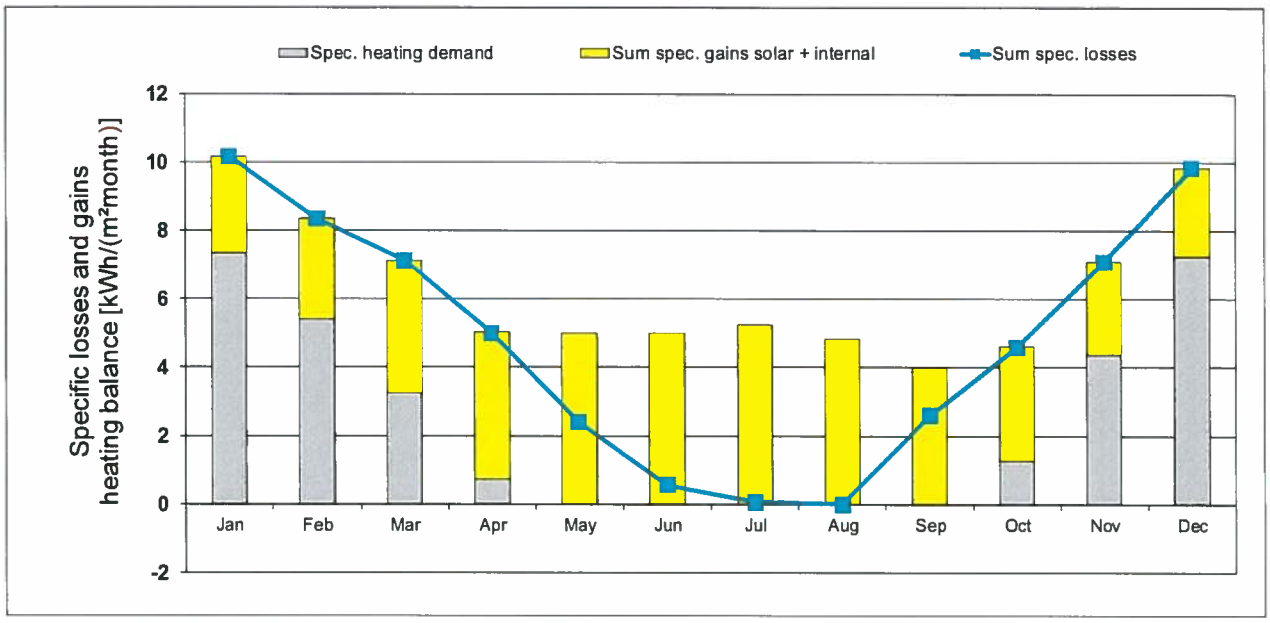
3.4. ENERGIJSKA UČINKOVITOST NOVOGRADNJE

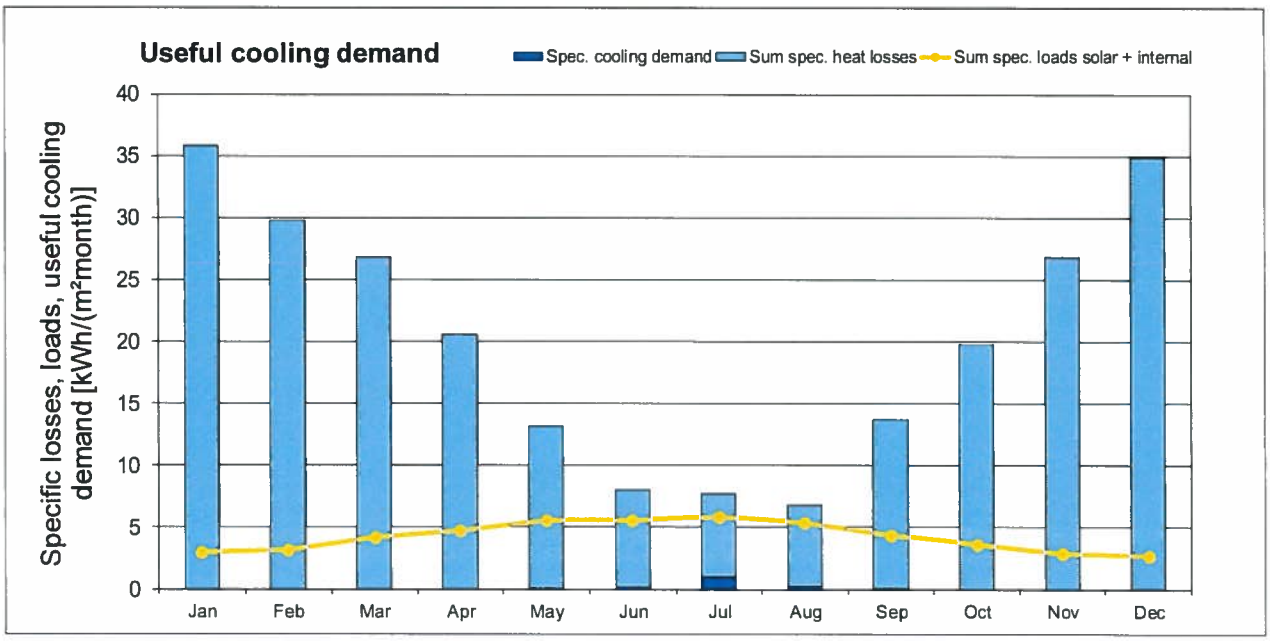
Energijska učinkovitost stavbe, izračunana po metodi PHPP z referenčnimi klimatskimi podatki razpisovalca, mora po zahtevi javnega poziva znašati $Q_h \leq 6$ kWh/m^{3}a, in je dejansko ovrednotena na vrednost 5,0 kWh/m^{3}a oziroma 29,6 kWh/m^{2}a, po mesečni metodi izračuna. Izpisi vseh ključnih elementov izračuna po metodologiji PHPP se nahajajo v prilogah.

Stavba praktično nima večjih potreb po aktivnem pohlajevanju, saj bi takšne energetske potrebe nastopile v obdobju, ko objekt ni v uporabi (poletje).

Glede na zasnovo toplotnega ovoja ter predpostavljene energetske sisteme je energijski kriterij izpolnjen z evidentirano večjo rezervo. Rezultat nastopa zaradi izboljšane toplotne zaščite ovoja stavbe, zaradi povečane energijske učinkovitosti prezračevanja in kakovostnega stavbnega pohištva. Upoštevati je potrebno tudi značilnosti oblikovanja stavbe ter njeno kompaktnost, zaradi katere je potrebna energija za

ogrevanje na enoto prostornine relativno nizka, ob primerjavi z rabo energije na enoto površine pa je specifična raba relativno višja.





Rezultat mesečne in letne metode izračuna potreb po energiji za ogrevanje in pohlajevanje

3.5. KONDICIONIRANA POVRŠINA IN PROSTORNINA STAVBE

V toplotnem ovoju stavbe se nahajajo – po popisu iz PZI načrtov arhitekture (tabele v prilogi) - prostori skupne površine 2.390,19 m^2.

Svetla tj. prezračevana višina prostorov se giblje v povprečni vrednosti 5,96 m. Neto volumen novogradnje, ki je upoštevan za izračun energijskega kazalnika, znaša 14.257,37 m^3.

3.6. VKLJUČEVANJE OVE V ENERGETSKO OSKRBO STAVBE

Novogradnja mora po zahtevah razpisovalca najmanj 50% letne dovedene energije za delovanje stavbe pokriti iz obnovljivih virov energije.

Novogradnja se s toploto oskrbuje iz več sistemov. Energijsko učinkovit sistem daljinskega ogrevanja na lesno biomaso in toplotna črpalka tipa zrak-voda pokrivata predvsem potrebe stavbe po toploti za ogrevanje prostorov in prezračevanje v ogrevalni sezoni. Sprejemniki sončne energije na strehi so namenjene pripravi tople sanitarne vode, predgrevanje pa z toploto odpadne vode. Segrevanje bazenske vode ni predmet tega vrednotenja. Eventualna pohlajevanja se izvajajo na pasivni način ter z aktivnimi s sistemi v stavbi, v katerih višek energije, ki je izvor potrebe po pohlajevanju, nastopa npr. kot vir energije za delovanje toplotne črpalke.

Po računskih podatkih iz ocene novogradnje po metodi PHPP so dobljene naslednje vrednosti za ključne segmente rabe energije v stavbi:

- Za ogrevanje in prezračevanje prostorov v času ogrevalne sezone se predvideva uporaba toplote iz toplotne črpalke tipa zrak-voda ter sistema daljinskega ogrevanja (lesna biomasa). Tehnična izvedba vezave omogoča napajanje z obema viroma, po potrebi, glede na temperaturne razmere.
- Pri dobavi toplote za pripravo tople vode se upošteva večinski delež, katerega pokriva termični solarni sistem, s projektantsko oceno vsaj 60 MWh/a. Eventualno razliko pa vir toplote za ogrevanje, npr. TČ.
- Električna energija se bo v glavnem uporabljala za delovanje naštetih sistemov ter za razsvetljavo in ostale manjše porabnike v stavbi.
- Za ogrevanje in prezračevanje prostorov je po računski oceni potrebno letno dovesti ca. 71 MWh/a toplotne energije. Za pripravo tople sanitarne vode in distribucijo vode in ogrevalnega medija je potrebno dovesti 90 MWh/a toplotne energije.
- Za razsvetljavo in ostale porabnike električne energije je ocenjena letna poraba elektrike na 18 MWh/a, za tehnične sisteme (prezračevanje, ogrevanje, toplotna oskrba) pa 15 MWh/a.

	delitev %	pokriva MWh/a	PHPP MWh/a
ogrevanje prostorov, DOLB	50%	36,0	71,0
ogrevanje prostorov, TČ	50%	35,0	
pohlajevanje, TČ	100%	5,0	5,0
topla voda, TČ	33%	30,2	90,2
topla voda, SONCE	67%	60,0	
tehnika	45%	14,9	32,9
razsvetljava, ostalo	55%	18	

Delitev energijskih potreb po nosilcih energije in tehnologijah

Ocenjuje se, da se s termičnim solarnim sistemom in toplotno črpalko zagotovi 54% delež OVE v dovedeni energiji za obratovanje, brez upoštevanja OVE v daljinskem sistemu ogrevanja, z njim vred pa 74%:

	POTREBNA ENERGIJA			DOVEDENA ENERGIJA				
	topl.ener. MWh/a	pretvorba %, COP	elektrika MWh/a	elektrika MWh/a	gorivo MWh/a	OVE zrak MWh/a	LB MWh/a	OVE sonce MWh/a
ogrevanje prostorov, DOLB	36,0	90%					40,0	
ogrevanje prostorov, TČ	35,0	3,5		10,0		25,0		
pohlajevanje, TČ	5,0	3,8		1,3		3,7		
topla voda, TČ	30,2	3,5		8,6		21,6		
topla voda, SONCE	60,0							60,0
tehnika			14,9	14,9				
razsvetljava, ostalo			18	18,0				
				52,8	0,0	50,3	40,0	60,0
				26,0%	0,0%	24,7%	19,7%	29,5%
						74,0%		

Ocena deleža OVE v dovedeni energiji za obratovanje stavbe

3.7. UPORABLJENI TOPLOTNO IZOLACIJSKI MATERIALI

V toplotnem ovoju novogradnje se po uskladitvah v PZI nahajajo toplotno izolacijski materiali pretežno mineralnega izvora, ki dosegajo volumski delež 85,2%.

Opisi sklopov toplotnega ovoja so podani v tabelah v nadaljevanju, novelirani opis konstrukcijskih sklopov iz PZI načrta arhitekture pa so v prilogi.

	A	sintetično	biološko	mineralno	sintetično	biološko	mineralno
PS-01 tla na terenu	8,0	0,080	0,000	0,500	0,6	0,0	4,0
PS-02 tla na terenu	366,6	0,080	0,000	0,500	29,3	0,0	183,3
PS-03 tla na terenu	99,6	0,080	0,000	0,500	8,0	0,0	49,8
PS-04 tla na terenu	278,9	0,000	0,000	0,500	0,0	0,0	139,5
PS-05 tla na terenu	220,5	0,000	0,000	0,500	0,0	0,0	110,2
PS-06 tla na terenu	354,6	0,000	0,000	0,500	0,0	0,0	177,3
KR-01 ravna AB streha s prodcem	41,0	0,320	0,000	0,000	13,1	0,0	0,0
KR-02 ravna AB streha z AB ploščami	7,7	0,320	0,000	0,000	2,5	0,0	0,0
KR-03 ravna AB streha s folijo	55,5	0,320	0,000	0,000	17,8	0,0	0,0
KR-04 poševni del strehe	1224,1	0,080	0,030	0,300	97,9	36,7	367,2
CO-01-02-03 cokl in izolacija temelja	153,1	0,220	0,000	0,000	33,7	0,0	0,0
ZO-03-04-05-08 zunanja AB stena s fasadnim panelom	639,3	0,000	0,000	0,250	0,0	0,0	159,8
ZO-07 fasadni panel z notranjo oblogo	243,8	0,000	0,025	0,250	0,0	6,1	60,9
ZO-09 fasadni panel	20,9	0,000	0,000	0,250	0,0	0,0	5,2
ZO-10 zunanja AB stena z izolacijo	48,0	0,000	0,000	0,255	0,0	0,0	12,2
ZO-12 ostrešje V-Z	130,0	0,000	0,000	0,630	0,0	0,0	81,9
ZO-13 ostrešje S-J	165,8	0,000	0,000	0,370	0,0	0,0	61,3
		0,000	0,000	0,000	0,0	0,0	0,0
					202,9	42,8	1412,8
					12,2%	2,6%	85,2%

3.8. OPISI SESTAV ELEMENTOV TOPLOTNEGA OVOJA STAVBE

Opisi so za potrebe izračunov in usklajevanj povzeti po seznamu iz faze PZI:

Assembly no. | Building assembly description | Interior insulation?

PS-01 tla na terenu

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor — interior R_{si}: 0,17

Adjacent to: 2-Ground — exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
cementni estrih	1,600					70
sistemske plošče za talno ogrevanje EPS 034	0,034	npr. Fragmat Stirotermal Duo		*debelina plošče brez čepkov, ostalo v estrihu*		30
EPS 034	0,034	npr. Fragmat EPS150				50
hidroizolacija	0,190					10
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 96,0 cm

U-value supplement: — W/(m²K)

U-value: 0,111 W/(m²K)

Assembly no. | Building assembly description | Interior insulation?

PS-02 tla na terenu

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor — interior R_{si}: 0,17

Adjacent to: 2-Ground — exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
keramika, lepilo	1,400					15
cementni estrih	1,600					75
sistemske plošče za talno ogrevanje EPS 034	0,034	npr. Fragmat Stirotermal Duo		*debelina plošče brez čepkov, ostalo v estrihu*		30
EPS 034	0,034	npr. Fragmat EPS150				50
hidroizolacija	0,190					10
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 98,0 cm

U-value supplement: — W/(m²K)

U-value: 0,111 W/(m²K)

Assembly no. | Building assembly description | Interior insulation?

PS-03 tla na terenu

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor — interior R_{si}: 0,17

Adjacent to: 2-Ground — exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
keramika	1,400					10
hidroizolacija	0,190					5
cementni estrih	1,600					75
sistemske plošče za talno ogrevanje EPS 034	0,034	npr. Fragmat Stirotermal Duo		*debelina plošče brez čepkov, ostalo v estrihu*		30
EPS 034	0,034	npr. Fragmat EPS150				50
hidroizolacija	0,190					10
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 98,0 cm

U-value supplement: — W/(m²K)

U-value: 0,111 W/(m²K)

Assembly no.

PS-04 tla na terenu

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor
Adjacent to: 2-Ground

interior R_{si}: 0,17
exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
zaščitni premaz	0,200					0
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: 80,0 cm

U-value supplement: W/(m²K)

U-value: 0,153 W/(m²K)

Assembly no.

PS-05 tla na terenu

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor
Adjacent to: 2-Ground

interior R_{si}: 0,17
exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: 80,0 cm

U-value supplement: W/(m²K)

U-value: 0,153 W/(m²K)

Assembly no.

PS-06 tla na terenu

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor
Adjacent to: 2-Ground

interior R_{si}: 0,17
exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
epoksi	0,200					1
AB plošča	2,200					300
penjeno steklo, nasutje	0,080	npr. Geocell				500

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: 80,1 cm

U-value supplement: W/(m²K)

U-value: 0,152 W/(m²K)

Assembly no.

KR-01 ravna AB streha s prodcem

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0,10

Adjacent to: 1-Outdoor air — exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB plošča	2,200					250
naklonski beton	2,200	naklon 0 do 55mm				28
parna zapora	0,190					1
XPS 036	0,036	npr. Fibran XPS 300				160
XPS 036	0,036	npr. Fibran XPS 300				160
strešna PVC folija	0,190					2
prodec	1,400					100

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 70,0 cm

U-value supplement: — W/(m²K)

U-value: 0,108 W/(m²K)

Assembly no.

KR-02 ravna AB streha z AB ploščami

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0,10

Adjacent to: 1-Outdoor air — exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB plošča	2,200					250
naklonski beton	2,200	naklon 0 do 55mm				28
parna zapora	0,190					1
XPS 036	0,036	npr. Fibran XPS 300				160
XPS 036	0,036	npr. Fibran XPS 300				160
strešna PVC folija	0,190					2
AB plošča	2,200					300

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 90,0 cm

U-value supplement: — W/(m²K)

U-value: 0,107 W/(m²K)

Assembly no.

KR-03 ravna AB streha s folijo

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0,10

Adjacent to: 1-Outdoor air — exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB plošča	2,200					200
naklonski beton	2,200	naklon 80 do 140mm				110
parna zapora	0,190					1
XPS 036	0,036	npr. Fibran XPS 300				160
XPS 036	0,036	npr. Fibran XPS 300				160
strešna PVC folija	0,190					2

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 63,3 cm

U-value supplement: — W/(m²K)

U-value: 0,109 W/(m²K)

Assembly no.: KR-04 poševni del strehe

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 1-Outdoor air

interior R_{si}: 0,13

exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
lesno vlaknene plošče 080	0,080	npr. AMF Heradesign superfine				30
sloj zraka	1,530					50
sloj zraka	1,530	lepljeni nosilci 16/20/100	0,130			200
OSB 2×	0,130					44
parna zapora, ločilni sloj	0,190					1
steklena volna 032	0,032			letvanje 20/15/150	0,130	150
steklena volna 032	0,032			letvanje 20/15/150	0,130	150
OSB	0,130					22
PIR v naklonu	0,027	npr. Bauder PIR MF 60				80
bitumenski in pokrivni sloj	0,200					8

Percentage of sec. 1: 77%

Percentage of sec. 2: 16,0%

Percentage of sec. 3: 6,7%

Total: 73,5 cm

U-value supplement: W/(m²K)

U-value: 0,080 W/(m²K)

Assembly no.: 12ud

CO-01-02-03 cokl in izolacija temelja

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 2-Ground

interior R_{si}: 0,13

exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB stena	2,200					250
hidroizolacija	0,190					10
XPS 035	0,035	npr. Fibran XPS 300				120
XPS 035	0,035	npr. Fibran XPS 300				100
gumbasta folija ali pločevinasta maska						

Percentage of sec. 1: 100%

Percentage of sec. 2:

Percentage of sec. 3:

Total: 48,0 cm

U-value supplement: W/(m²K)

U-value: 0,152 W/(m²K)

Assembly no.: 13ud

ZO-03-04-05-08 zunanja AB stena s fasadnim panelom

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 1-Outdoor air

interior R_{si}: 0,13

exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB stena	2,200	(v delu notri keramika, akustična plošča, ipd)				250
mirujoči zrak	0,300	(tudi podkonstrukcija)				55
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 250				249
pločevina	50,000					1

Percentage of sec. 1: 100%

Percentage of sec. 2:

Percentage of sec. 3:

Total: 55,5 cm

U-value supplement: W/(m²K)

U-value: 0,143 W/(m²K)

Assembly no. 14ud — ZO-07 fasadni panel z notranjo oblogo

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 1-Outdoor air

interior R_{si}: 0,13

exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
lesene akustične plošče	0,095	npr. AMF Heradesign				25
mirujoči zrak	1,820	(tudi podkonstrukcija)				280
mirujoči zrak	1,820	(tudi podkonstrukcija)				55
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 250				249
pločevina	50,000					1

Percentage of sec. 1: 100%

Percentage of sec. 2:

Percentage of sec. 3:

Total: 61,0 cm

U-value supplement: W/(m²K)

U-value: 0,140 W/(m²K)

Assembly no. 15ud — ZO-09 fasadni panel

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 1-Outdoor air

interior R_{si}: 0,13

exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 250				249
pločevina	50,000					1

Percentage of sec. 1: 100%

Percentage of sec. 2:

Percentage of sec. 3:

Total: 25,0 cm

U-value supplement: W/(m²K)

U-value: 0,149 W/(m²K)

Assembly no. 16ud — ZO-10 zunanja AB stena z izolacijo

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall

Adjacent to: 1-Outdoor air

interior R_{si}: 0,13

exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
AB stena	2,200					250
kamena volna 035	0,035	med pocinkanimi profili		npr. Knauf Insulation Unifit 035		120
lesna volna	0,100					8
kamena volna 040	0,040	npr. kombi plošča DRVOTERM DTO3				135
lesna volna	0,100					8

Percentage of sec. 1: 100%

Percentage of sec. 2:

Percentage of sec. 3:

Total: 52,0 cm

U-value supplement: 0,01 W/(m²K)

U-value: 0,148 W/(m²K)

Assembly no. 17ud | ZO-12 ostrešje V-Z | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall | interior R_{si}: 0,13

Adjacent to: 1-Outdoor air | exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
stenska obloga	0,200					25
parna zapora	0,190	parna zapora	0,190			0
kamena volna 035	0,035	npr. Knauf Insulation Unifit 035		lesena podkonstrukcija	0,130	220
kamena volna 035	0,035	npr. Knauf Insulation Unifit 035		lesena podkonstrukcija	0,130	240
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 172				171
pločevina	50,000					1

Percentage of sec. 1: 85% | Percentage of sec. 2: | Percentage of sec. 3: 15,0% | Total: 65,7 cm

U-value supplement: W/(m²K)

U-value: 0,068 W/(m²K)

Assembly no. 18ud | ZO-13 ostrešje S-J | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall | interior R_{si}: 0,13

Adjacent to: 1-Outdoor air | exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
leseni strešni nosilec	0,130					280
parna zapora	0,190					0
kamena volna 035	0,035	npr. Knauf Insulation Unifit 035		lesena podkonstrukcija	0,130	200
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 172				171
pločevina	50,000					1

Percentage of sec. 1: 85% | Percentage of sec. 2: | Percentage of sec. 3: 15,0% | Total: 65,2 cm

U-value supplement: W/(m²K)

U-value: 0,089 W/(m²K)

Assembly no. 19ud | | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall | interior R_{si}: 0,13

Adjacent to: 1-Outdoor air | exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
stenska obloga	0,200					25
mirujoči zrak	1,800					360
parna zapora	0,190					0
kamena volna 035	0,035	npr. Knauf Insulation Unifit 035		lesena podkonstrukcija	0,130	100
pločevina	50,000					1
kamena volna 038	0,038	npr. panel Trimo FTV 172				171
pločevina	50,000					1

Percentage of sec. 1: 100% | Percentage of sec. 2: | Percentage of sec. 3: | Total: 65,7 cm

U-value supplement: W/(m²K)

U-value: 0,128 W/(m²K)

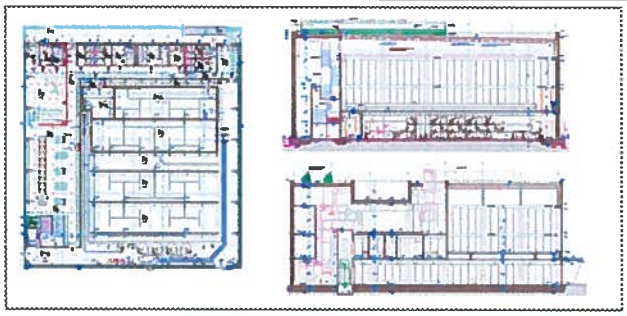
4. PRILOGE

4.1. POVRŠINE IN PROSTORNINE NOVOGRADNJE

etaža	št.	prostor	m2	m3	ogrevano	sestava tlaka
Pritličje						
	P.01	vetrolov	6,76	18,25	21 °C	PS-01
	P.02	WC m	6,07	16,39	20 °C	PS-03
	P.03	WC ž+inv.	5	13,49	20 °C	PS-03
	P.04	avla	64,32	173,67	21 °C	PS-02
	P.05	garderobe	142,15	383,81	24 °C	PS-02
	P.06	stopnice	4,27	16,65	20 °C	-
	P.07	hodnik	55,32	149,36	24 °C	PS-02
	P.08	prhe m	7,67	20,7	24 °C	PS-03
	P.09	prhe ž	7,55	20,38	24 °C	PS-03
	P.10	WC ž	10,92	29,49	24 °C	PS-03
	P.11	WC m	15,2	41,04	24 °C	PS-03
	P.12	previjalnica	6,96	18,8	24 °C	PS-03
	P.13	hodnik	9,99	26,98	20 °C	PS-02
	P.14	gard os. m	7,48	20,2	20 °C	PS-03
	P.15	gard. os. ž	7,57	20,45	20 °C	PS-03
	P.16	odmor os.	17,59	47,5	20 °C	PS-02
	P.17	čistila	4,59	13,95	20 °C	PS-03
	P.18	baz. teh	20,15	70,03	posredno	PS-04
	P.19	komp. baz. nepl.	32,67	68,61	posredno	PS-04
	P.20	rezerv. odp. voda	66,5	139,65	posredno	PS-04
	P.21	komp. baz.	100,62	211,31	posredno	PS-04
	P.22	teh.prostor	61,82	129,38	posredno	PS-05
	P.23	teh.prostor	53,98	156,55	posredno	PS-05
	P.24	teh.prostor	53,98	156,55	posredno	PS-05
	P.25	Teh. prostor (filtri)	274,84	955,08	posredno	PS-06
	P.26	dvig. jašek	3,65	17,9	posredno	PS-05
	P.29	teh. prostor	9,76	32,71	posredno	-
			1.057,38 m²	**2.968,88 m³**		
Nadstropje						
	N.01	stopnice	13,96	48,1	- °C	-
	N.02	hodnik	11,97	32,31	24 °C	PS-07
	N.03	hodnik	21,75	58,73	24 °C	PS-08
	N.04	WC ž+inv.	4,46	12,05	24 °C	PS-08
	N.05	WC ž	3,29	8,89	24 °C	PS-08
	N.06	WC m	6,14	16,59	24 °C	PS-08
	N.07	prhe	4,3	11,61	24 °C	PS-09
	N.08	reševalec	6,9	18,62	24 °C	PS-07
	N.09	prva pomoč	12,95	34,96	24 °C	PS-07
	N.10	ploščad 25m	459,03	1687,18	28 °C	PS-09
	N.11	prhe	4,03	13,14	28 °C	PS-09
	N.12	bazen 25m	516,85	1679,25	28 °C	PS-10
	N.13	stopnice	4,13	15,37	20 °C	-
	N.14	ploščad nepl.	62,48	145,1	28 °C	PS-09
	N.15	bazen nepl.	34,41	82,62	28 °C	PS-11
	N.16	stopnice	3,1	10,06	20 °C	-
	N.17	shramba	10,45	31,35	- °C	PS-07
	N.18	čistila	5,72	17,15	- °C	PS-07
	N.19	dvig. jašek	0	13,15	- °C	-
	N.20	stopnice	2,32	6,55	20 °C	-
	N.21	inst. jašek	0	22,08	- °C	-
			1.188,24 m²	**3.964,86 m³**		
Tehnična etaža						
	T.01	stopnice	10,19	54,31	- °C	-
	T.02	stopnice	2,12	13,42	- °C	-
	T.03	klimat	87,93	348,39	- °C	PS-12
	T.04	inst. jašek	0	21,46	- °C	-
	T.05	Teh. prostor	16,58	59,53	- °C	PS-12
	T.06	bazenska dvorana	0,01	4415,31	28 °C	-
			116,83 m²	**4.912,42 m³**		
Ostrešje						
	O.01	stopnice	9,94	25,05	- °C	-
	O.03	inst. prostor	17,79	44,83	- °C	-
	O.04	inst. jašek	0	40,65	- °C	-
	O.05	inst. jašek	0	64,79	- °C	-
	O.06	bazenska dvorana	0,01	2235,89	28 °C	-
			27,74 m²	**2.411,21 m³**		
			2.390,19 m²	**14.257,37 m³**		

4.2. IZPIS KLJUČNIH SEGMENTOV IZRAČUNA PHPP

PHPP-Energy balance calculation



Building:	Plavalni zimski bazen
Street:	parc.št. 555, 554/4, 632/16 in 632/22 k.o. Nova Gorica
Postcode/City:	5000 Nova Gorica
Province/Country:	Slovenija SI-Slovenia
Building type:	Športni objekt
Climate data set:	ud—01-Ljubljana - referenčno
Climate zone:	3: Cool-temperate Altitude of location: 309 m
Home owner / Client:	Mestna občina Nova Gorica
Street:	Trg Edvarda Kardelja 1
Postcode/City:	5000 Nova Gorica
Province/Country:	Slovenija SI-Slovenia

Architecture:	Projekt d.d.
Street:	Kidričeva ulica 9a
Postcode/City:	5000 Nova Gorica
Province/Country:	Slovenija SI-Slovenia
Mechanical engineer:	MM-BIRO d.o.o.
Street:	Tolminskih puntarjev 4
Postcode/City:	5000 Nova Gorica
Province/Country:	Slovenija SI-Slovenia
Energy consultancy:	dr. Miha Praznik, Gradbeni inštitut ZRMK d.o.o.
Street:	Dimičeva 12
Postcode/City:	1000 Ljubljana
Province/Country:	Slovenija SI-Slovenia
Certification:	
Street:	
Postcode/City:	
Province/Country:	

Year of construction:	2020	Interior temperature winter [°C]	20,0	Interior temp. summer [°C]	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,8	IHG cooling case [W/m²]	2,8
No. of occupants:	150,0	Specific capacity [Wh/K per m² TFA]	204	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area m²	2390,2				
Space heating	Heating demand kWh/(m²a)	29,6	≤	-	-	no
	kWh/(m³a)	5,0	≤	6,0		
	Heating load W/m²	18	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	1	≤	-	-	-
	Cooling load W/m²	7	≤	-	-	
	Frequency of overheating (> 25 °C) %	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	-		-
Airtightness	Pressurization test result n_{50} 1/h	0,6	≤	-		-
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	87	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	104	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	6	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

Task:	First name: Miha	Surname: Praznik	Signature: -
Gradbeni inštitut ZRMK d.o.o.	Issued on: 22.07.19	City: Ljubljana	

IZRAČUN JE IZDELAN PO ROBNIH POGOJIH RAZPISOVALCA FINAČNIH SPODBUD

Climate data

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Selection of climate data

Country	ud-User Data
Region	All
	2-Sorting: BY ID
Climate data set	ud—01-Ljubljana - referenčno
Climate zone	3: Cool-temperate

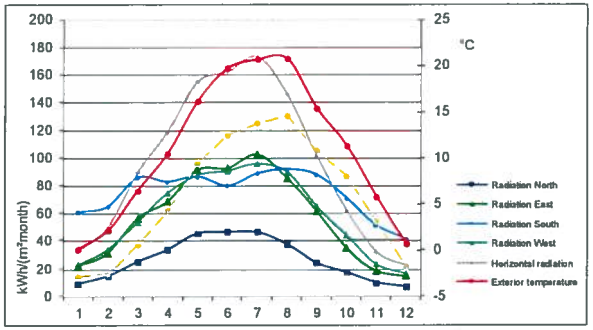
Altitude

Weather station	309,0	m
Building location	309	m

Result overview

Annual heating demand	29,6	kWh/(m²a)
Heating load	18,2	W/m²
Frequency of overheating	-	%
Sensible cooling	1,3	kWh/(m²a)
Latent cooling	0,2	kWh/(m²a)
Cooling load	7,3	W/m²
PER demand	103,7	kWh/(m²a)

	Data for heating Annual method	Data from monthly balance Heating	Cooling	
Heating / cooling period	188	242	183	d/a
Heating / cooling degree hours	71	80	-36	kKh/a
Radiation North	94	144	243	kWh/(m²a)
Radiation East	201	348	526	kWh/(m²a)
Radiation South	383	546	519	kWh/(m²a)
Radiation West	215	303	477	kWh/(m²a)
Horizontal radiation	322	509	856	kWh/(m²a)



	Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load Weather 1	Heating load Weather 2	Cooling load Weather 1	Cooling load Weather 2	PER factors	
	Days	31	28	31	30	31	30	31	31	30	31	30	31						
	ud—01-Ljubljana - referenčno	Latitude °	46,1	Longitude °	14,5	Altitude [m]	309	Daily temperature swing Summer [K]			9,9			Radiation: [W/m²]		Radiation: [W/m²]			
°C	Exterior temperature	0,1	2,1	6,5	10,5	16,2	19,7	20,7	20,8	15,4	11,4	5,8	0,7	-6,8	-5,9	25,9	25,9	1,30	Household electr
kWh/(m²month)	Radiation North	9	15	26	34	46	47	47	38	25	18	10	7	11	8	47	47	1,30	Domestic hot wa
kWh/(m²month)	Radiation East	23	32	57	69	92	93	103	86	62	35	19	15	29	9	114	114	1,85	Heating
kWh/(m²month)	Radiation South	61	65	86	83	87	80	89	92	88	71	51	41	88	39	131	131	1,15	Cooling
kWh/(m²month)	Radiation West	24	34	54	75	88	91	96	90	65	44	24	17	32	29	124	124	1,40	Dehumidification
kWh/(m²month)	Horizontal radiation	32	50	90	119	155	162	173	146	101	62	32	23	41	23	203	203		
°C	Dew point temperature	-2,8	-2,5	0,6	4,3	9,4	12,5	13,8	14,6	10,8	8,1	3,1	-1,7			17,6	17,6		
°C	Sky temperature	-11,2	-10,4	-6,4	-1,9	4,0	8,2	9,2	9,9	5,4	2,6	-3,3	-9,4			15,2	17,6		
°C	Ground temperature	13,2	13,0	13,0	13,3	13,8	15,6	16,1	16,3	15,0	14,7	14,2	13,7	13,0	13,0	16,3	16,3		
	Comment	Eko sklad. referenca																	

Areas determination

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment
	Treated floor area	1	2390,19	m²	Treated floor area according to PHPP manual
A	North windows	2	237,79	m²	
A	East windows	3	189,30	m²	Results come from the Windows worksheet.
A	South windows	4	0,00	m²	Window areas are subtracted from individual opaque areas
A	West windows	5	298,79	m²	which is displayed in the 'Windows' worksheet.
A	Horizontal windows	6	0,00	m²	
A	Exterior door	7	15,24	m²	Please subtract area of door from respective building assembly
A	External wall - Ambient	8	1291,55	m²	Temperature zone "A" is ambient air
B	External wall - Ground	9	189,35	m²	Temperature zone "B" is the ground
A	Roof/Ceiling - Ambient	10	1328,24	m²	
B	Floor slab / Basement ceiling	11	1328,24	m²	
		12	0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"
		13	0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I" — Factor for X
X		14	0,00	m²	Temperature zone "X". Please provide user-defined reduction factor (0 < fi < 1)
A	Thermal bridges Ambient	15	35,85	m	Units in m
P	Perimeter thermal bridges	16	145,80	m	Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)
B	Thermal bridges PS/BC	17	0,00	m	Units in m
I	Building element towards neig	18	0,00	m²	No heat losses, only considered for the heating load calculation
Total thermal envelope			4806,47	m²	

Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/m²]	Radiation-load cooling period [kWh/m²]
		6 Months	6 Months
North windows	0,799	4541	8441
East windows	0,731	7177	13571
South windows			
West windows	0,748	5398	10552
Horizontal windows			
Exterior door	0,867		
External wall - Ambient	0,129	1218	1959
External wall - Ground	0,152		
Roof/Ceiling - Ambient	0,083	642	2327
Floor slab / Basement ceiling	0,139		
Thermal bridges - Overview	Ψ [W/(mK)]		
Thermal bridges Ambient	0,200		
Perimeter thermal bridges	0,950		
Thermal bridges PS/BC			
Building element towards neighbour			
Average therm. envelope	0,229		

Go to building components list

Area input

2-Boring, BY ID

Area no.	Building assembly description	To group No.	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User determined [m²]	-	User subtraction [m²]	-	Subtraction window areas [m²]	) =	Area [m²]	Selection building assembly / Building system	U-Value [W/(m²K)]	Deviation from North	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity
	Projected building footprint	0	Projected building footprint	1	x (	35,85	x	37,95	+		-		)		=	1328,2								
	Treated floor area	1	Treated floor area		x (		x		+		-		)		=	0,0								
	Exterior door	7	Exterior door		x (		x		+		-		) -		=		Exterior door							
1	neto površina:				x (		x		+		-		) -	0,0	=				10					
2	kondicionirana površin	1	Treated floor area	1	x (		x		+	2390,19	-		) -	0,0	=	2390,2								
3					x (		x		+		-		) -	0,0	=									
4	prostornina:				x (		x		+		-		) -	0,0	=									
5	neto prostornina				x (		x		+	14257,37	-		) -	0,0	=									
6	povprečna svetla višina				x (		x		+	5,96	-		) -	0,0	=									
7					x (		x		+		-		) -	0,0	=									
8	tla na terenu PS-01	11	Floor slab / Basement ceiling	1	x (	0,01	x	1328,24	+		-		) -	0,0	=	0,0	01c4-PS-01 tla na terenu	0,111						
9	tla na terenu PS-02	11	Floor slab / Basement ceiling	1	x (	0,28	x	1328,24	+		-		) -	0,0	=	366,6	02c4-PS-02 tla na terenu	0,111						
10	tla na terenu PS-03	11	Floor slab / Basement ceiling	1	x (	0,08	x	1328,24	+		-		) -	0,0	=	99,6	03c4-PS-03 tla na terenu	0,111						
11	tla na terenu PS-04	11	Floor slab / Basement ceiling	1	x (	0,21	x	1328,24	+		-		) -	0,0	=	278,9	04c4-PS-04 tla na terenu	0,153						
12	tla na terenu PS-05	11	Floor slab / Basement ceiling	1	x (	0,17	x	1328,24	+		-		) -	0,0	=	220,5	05c4-PS-05 tla na terenu	0,153						
13	tla na terenu PS-06	11	Floor slab / Basement ceiling	1	x (	0,26	x	1328,24	+		-		) -	0,0	=	348,0	06c4-PS-06 tla na terenu	0,152						
14	tla na terenu PS-ostalo	11	Floor slab / Basement ceiling	1	x (	0,00	x	1328,24	+		-		) -	0,0	=	6,6	06c4-PS-06 tla na terenu	0,152						
15					x (		x		+		-		) -	0,0	=									
16	streha KR-01 predec	10	Roof/Ceiling - Ambient	1	x (	6,45	x	7,55	+		-	7,88	) -	0,0	=	41,0	07c4-KR-01 ravna AB streha s predem	0,108	250	0	Hor	1,00	0,70	0,90
17	streha KR-02 TČ	10	Roof/Ceiling - Ambient	2	x (	3,20	x	1,20	+		-		) -	0,0	=	7,7	08c4-KR-02 ravna AB streha z AB ploščami	0,107	250	0	Hor	1,00	0,70	0,90
18	streha KR-03 folija	10	Roof/Ceiling - Ambient	1	x (	6,45	x	18,15	+		-	48,78	) -	0,0	=	55,5	09c4-KR-03 ravna AB streha s folijo	0,108	250	0	Hor	1,00	0,70	0,90
19	streha KR-04 lesena	10	Roof/Ceiling - Ambient	1	x (	35,85	x	37,95	+		-	164,17	) -	0,0	=	1224,1	10c4-KR-04 poševni del strehe	0,080	100	10	Hor	1,00	0,70	0,90
20					x (		x		+		-		) -	0,0	=									
21	izolacija temelja	9	External wall - Ground	1	x (	145,80	x	0,75	+		-		) -	0,0	=	109,4	11c4-ZO-01-02-03 zolid iz izolacija temelja	0,152		90				
22	zidi AB stene	8	External wall - Ambient	1	x (	145,80	x	0,30	+		-		) -	0,0	=	43,7	11c4-ZO-01-02-03 zolid iz izolacija temelja	0,152	10	90	North	0,50	0,70	0,90
23					x (		x		+		-		) -	0,0	=									
24	AB stena s panelom J P+B	8	External wall - Ambient	1	x (	10,20	x	6,70	+		-	3,96	) -	0,0	=	64,4	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	190	90	South	1,00	0,70	0,90
25	AB stena s panelom JZ celotna višina	8	External wall - Ambient	1	x (	3,70	x	35,85	+		-		) -	0,0	=	132,6	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	190	90	South	1,00	0,70	0,90
26	Fasada J	8	External wall - Ambient	1	x (	7,10	x	29,15	+		-		) -	0,0	=	207,0	13c4-ZO-07 fasadni panel z notranjo oblogo	0,148	190	90	South	1,00	0,70	0,90
27	Fasada J venec streh	8	External wall - Ambient	1	x (	2,55	x	29,15	+		-		) -	0,0	=	74,3	17c4-ZO-13 ostrešje S-J	0,080	190	90	South	1,00	0,70	0,90
28	vrata VZ-05	7	Exterior door	1	x (	1,80	x	2,20	+		-		) -	0,0	=	4,0	03c4-Zunanja vrata Ud < 0,9	0,900	190	90	South	1,00	0,70	0,90
29					x (		x		+		-		) -	0,0	=									
30	AB stena s panelom V P+B	8	External wall - Ambient	1	x (	37,05	x	3,70	+		-		) -	0,0	=	137,1	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	190	90	East	1,00	0,70	0,90
31	AB stena s panelom JV sredina	8	External wall - Ambient	1	x (	7,15	x	5,75	+		-		) -	0,0	=	41,1	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	100	90	East	1,00	0,70	0,90
32	stena s panelom JV sredina	8	External wall - Ambient	1	x (	7,15	x	5,15	+		-		) -	0,0	=	36,8	13c4-ZO-07 fasadni panel z notranjo oblogo	0,148	100	90	East	1,00	0,70	0,90
33	Fasada V venec streh	8	External wall - Ambient	1	x (	37,05	x	2,30	+		-		) -	0,0	=	85,2	16c4-ZO-12 ostrešje V-Z	0,083	100	90	East	1,00	0,00	0,00
34	Fasada V steklen del				x (		x		+	189,30	-		) -	189,4	=				100	90	East			
35					x (		x		+		-		) -	0,0	=									
36	AB stena s panelom S P+B	8	External wall - Ambient	1	x (	27,15	x	3,70	+		-	4,68	) -	0,0	=	95,8	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	10	90	North	1,00	0,70	0,90
37	Fasada S steklen del P+B				x (		x		+	29,58	-		) -	29,6	=				10	90	North			
38	vrata VZ-03+04	7	Exterior door	2	x (	0,90	x	2,60	+		-		) -	0,0	=	4,7	03c4-Zunanja vrata Ud < 0,9	0,900	10	90	North	1,00	0,70	0,90
39	Fasada S steklen del N				x (		x		+	258,12	-		) -	258,1	=				10	90	North			
40	Fasada S venec streh	8	External wall - Ambient	1	x (	35,85	x	2,55	+		-		) -	0,0	=	91,4	17c4-ZO-13 ostrešje S-J	0,080	10	10	Hor	1,00	0,70	0,90
41					x (		x		+		-		) -	0,0	=									
42	AB stena s panelom Z P	8	External wall - Ambient	1	x (	7,80	x	3,70	+	9,61	-	6,60	) -	0,0	=	31,1	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	250	90	West	1,00	0,70	0,90
43	Fasada Z steklen del P				x (		x		+	99,79	-		) -	99,8	=				250	90	West			
44	AB stena s panelom Z B	8	External wall - Ambient	1	x (	7,80	x	3,10	+		-		) -	0,0	=	24,2	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	250	90	West	1,00	0,70	0,90
45	Fasada Z steklen del B				x (		x		+	90,99	-		) -	91,0	=				250	90	West			
46	Fasada Z steklen del B2				x (		x		+	66,01	-		) -	66,0	=				250	90	West			
47	AB stena s panelom Z B2	8	External wall - Ambient	1	x (	16,00	x	4,10	+		-		) -	0,0	=	65,6	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	250	90	West	1,00	0,70	0,90
48	Fasadni panel tehnika Z	8	External wall - Ambient	1	x (	5,16	x	4,10	+		-		) -	0,0	=	20,9	14c4-ZO-09 fasadni panel	0,148	250	90	West	1,00	0,70	0,90
49	AB stena s panelom Z JZ	8	External wall - Ambient	1	x (	7,30	x	0,65	+		-		) -	0,0	=	4,7	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	250	90	West	1,00	0,70	0,90
50	AB stena s panelom Z Z	8	External wall - Ambient	1	x (	21,15	x	2,85	+		-	17,52	) -	0,0	=	42,8	12c4-ZO-03-04-05-06 zmesnja AB stena s fasadnim panelom	0,143	250	90	West	1,00	0,70	0,90
51	Fasada Z venec streh	8	External wall - Ambient	1	x (	16,00	x	2,80	+		-		) -	0,0	=	44,8	16c4-ZO-12 ostrešje V-Z	0,083	250	90	West	1,00	0,70	0,90
52	Stena proti TČ Z	8	External wall - Ambient	1	x (	7,30	x	2,40	+		-		) -	0,0	=	17,5	15c4-ZO-10 zmesnja AB stena z toplotnjo	0,148	250	90	West	0,50	0,70	0,90
53	Stena proti TČ S	8	External wall - Ambient	1	x (	6,35	x	2,40	+		-		) -	0,0	=	15,2	15c4-ZO-10 zmesnja AB stena z toplotnjo	0,148	10	90	North	0,50	0,70	0,90
54	Stena proti TČ J	8	External wall - Ambient	1	x (	6,35	x	2,40	+		-		) -	0,0	=	15,2	15c4-ZO-10 zmesnja AB stena z toplotnjo	0,148	190	90	South	0,50	0,70	0,90
55	Evakuacijska vrata VZ-06	7	Exterior door	1	x (	2,00	x	3,30	+		-		) -	0,0	=	6,6	03c4-Evakuacijska vrata Ud < 1,1	1,100	250	90	West	1,00	0,70	0,90
56					x (		x		+		-		) -	0,0	=									
57					x (		x		+		-		) -	0,0	=									

To thermal bridges list

Thermal bridge inputs

Change order

No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [m]	-	Subtraction length [m]	) =	Length l [m]	User determined psi value [W/(mK)]	User determined $f_{Rsi-0,25}$ (optional)	or	Selection building system	Ψ-value [W/(mK)]	f_{Rsi}-Requirement met?
1	temeljna plošča	16	Perimeter thermal bridges	1	x (	145,80	-		=	145,80	0,950		or		0,950	
2	plošča terasa	15	Thermal bridges Ambient	1	x (	35,85	-		=	35,85	0,200		or		0,200	
3					x (		-		=				or			

Heat losses through the ground

Energy balance calculation with PHPP Version 9.6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Building section 1

Ground characteristics			
Thermal conductivity	λ	2,0	W/(mK)
Heat capacity	ρc	2,0	MJ/(m³K)
Periodic penetration depth	δ	3,17	m

Climate data			
Avg indoor temp. winter	T_i	20,0	°C
Avg indoor temp. summer	T_i	25,0	°C
Avg ground surface temperature	$T_{g,ave}$	11,8	°C
Amplitude of $T_{g,ave}$	$T_{g,\wedge}$	10,4	°C
Phase shifting of $T_{e,m}$	τ	1,0	Months
Length of the heating period	n	6,2	Months
Heating degree hours - exterior	G_t	71,4	kKh/a

Building data							
Area of ground floor slab / basement	A	1328,2	m²	U-value floor slab/basement ceiling	U_f	0,111	W/(m²K)
Perimeter length	P	145,8	m	TBs floor slab / basement ceiling	Ψ_B*1	7,29	W/K
Charact. dimension of floor slab	B'	18,22	m	U-value floor slab / basement ceiling	U_f'	0,116	W/(m²K)
				Equivalent thickness floor	d_t	17,19	m

Floor slab type (select only one)

x **Slab on grade**

Perimeter insulation width/depth	D	0,75	m	Orientation of perimeter insulation	horizontal		
Perimeter insulation thickness	d_n	0,22	m	(check only one field)	vertical	x	
Conductivity perimeter insulation	λ_n	0,036	W/(mK)				

Heated basement or floor slab completely / partially below ground level

Basement wall height below ground l	z		m	U-Value wall below ground	U_{wB}		W/(m²K)

Unheated basement

Height aboveground wall	h		m	U-Value wall above ground	U_W		W/(m²K)
Basement wall height below ground l	z		m	U-Value wall below ground	U_{WB}		W/(m²K)
Air change unheated basement	n		h⁻¹	U-Value basement floor slab	U_{fB}		W/(m²K)
Air volume basement	V		m³				

Suspended floor above a ventilated crawl space (at max. 0.5 m below ground)

U-Value crawl space	U_{Crawl}		W/(m²K)	Area of ventilation openings	εP		m²
Height of crawl space wall	h		m	Wind velocity at 10 m height	v	4,0	m/s
U-Value crawl space wall	U_W		W/(m²K)	Wind shield factor	f_W	0,05	-

Additional thermal bridge heat losses at perimeter							
				Steady-state fraction	$\Psi_{P\,stat}$*1		W/K
Phase shift	β		Months	Harmonic fraction	$\Psi_{P\,harm}$*1		W/K

Groundwater correction							
Depth of the groundwater table	z_w	3,0	m	Groundwater correction factor	G_w	1,11842784	-
Groundwater flow rate	q_w	0,05	m/d				

Interim results

Phase shift	β	1,43	Months	Steady-state heat flow	Φ_{stat}	928,6 W
Steady-state transmittance	L_S	113,59	W/K	Periodic heat flow	Φ_{harm}	73,0 W
Exterior periodic transmittance	L_{pe}	15,56	W/K	Heat losses during heating period	Q_{tot}	4510 kWh
Transmittance building	L_0	154,55	W/K			

Monthly average temperatures in the ground for monthly method (building assembly 1)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	13,2	13,0	13,0	13,3	13,8	14,3	14,8	15,0	15,0	14,7	14,2	13,7	14,0
Summer	14,5	14,3	14,3	14,6	15,1	15,6	16,1	16,3	16,3	16,0	15,5	15,0	15,3

Design ground temperature for 'Heating load' worksheet 13,0 **For 'Cooling load' worksheet** 16,3

Reduction factor for 'Annual heating' worksheet 0,41

Total result (all building parts)

Phase shift	β	1,43	Months	Steady-state heat flow	Φ_{stat}	928,6 W
Steady-state transmittance	L_S	113,59	W/K	Periodic heat flow	Φ_{harm}	73,0 W
Exterior periodic transmittance	L_{pe}	15,56	W/K	Heat losses during heating period	Q_{tot}	4510 kWh
Transmittance building	L_0	154,55	W/K	Charact. dimension of floor slab	B'	18,22 m

Monthly Average temperatures in the ground for monthly method (all building assemblies)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	13,2	13,0	13,0	13,3	13,8	14,3	14,8	15,0	15,0	14,7	14,2	13,7	14,0
Summer	14,5	14,3	14,3	14,6	15,1	15,6	16,1	16,3	16,3	16,0	15,5	15,0	15,3

Design ground temperature for 'Heating load' worksheet 13,0 **For 'Cooling load' worksheet** 16,3

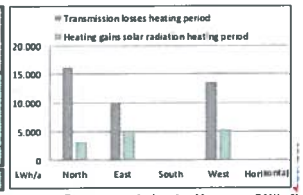
Reduction factor for 'Annual heating' worksheet **0,41**

Windows

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Window area orientation	Global radiation (min orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation
Standard values -->	kWh/(m²a)	0,75	0,95	0,85				m²	W/(m²K)	m²	kWh/(m²a)
North	94	0,79	0,95	0,85	0,78	0,22	0,50	287,70	0,79	224,77	94
East	201	0,77	0,95	0,85	0,79	0,22	0,50	189,36	0,73	150,10	227
South	383	1,00	0,95	0,85	0,00	0,00	0,00	0,00	0,00	0,00	383
West	215	0,77	0,95	0,85	0,79	0,22	0,49	256,79	0,74	202,46	191
Horizontal	322	1,00	0,95	0,85	0,00	0,00	0,00	0,00	0,00	0,00	322
Total or average value for all windows						0,22	0,49	733,85	0,76	577,33	

	Transmission losses heating period	Heating gains solar radiation heating period
	kWh/a	kWh/a
North	16179	2966
East	9878	4677
South	0	0
West	13566	5274
Horizontal	0	0
	39622	12917



Recommendation for $U_{w,installed}$ [W/(m²K)]

E	E	E	E
0,85	1,00	1,10	0,52

Heating degree hours [kKh/a] 71,4

Go to glazing list Go to window frames list

Qua-n-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien-tation	Window rough openings: Width	Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	g-Value: Perpen-dicular radiation	U-Value: Glazing	Frames (avg.)	Ψ Glazing edge: $\Psi_{Glazing\ edge}$ (Avg.)	Installation situation (user determined value for $\Psi_{installation}$ or "1": $\Psi_{installation}$ from 'Components' worksheet; '0': in the case of abutting windows): left	right	bottom	top	$\Psi_{installation}$ (Avg.)	Results: Window Area	Glazing area	U_w installed	Glazed fraction per window
		-	-		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
1	SSZ-05	100	90	East	1,012	4,150	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	0	1	0	1	0,020	4,2	3,36	0,74	80%
24		100	90	East	1,012	4,150	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	0	0	0	1	0,020	100,7	80,38	0,72	80%
1		100	90	East	1,012	4,150	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	1	0	0	1	0,020	4,2	3,36	0,74	80%
1		100	90	East	1,012	3,050	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	0	1	1	0	0,020	3,1	2,42	0,76	79%
24		100	90	East	1,012	3,050	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	0	0	1	0	0,020	74,8	58,17	0,74	79%
1		100	90	East	1,012	3,050	34-Fasada V stekleni del	04ud-fasadna stekla	09ud-V fasada Schuco	0,22	0,50	0,81	0,068	1	0	1	0	0,020	3,1	2,42	0,76	79%
1	SSZ-02, VZ-01, VZ-02	10	90	North	0,967	3,400	37-Fasada S stekleni del P+B	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	1	1	1	0,020	3,3	2,57	0,81	78%
7		10	90	North	0,967	3,400	37-Fasada S stekleni del P+B	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	0	1	1	0,020	23,0	18,01	0,79	78%
1		10	90	North	0,967	3,400	37-Fasada S stekleni del P+B	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	1	0	1	1	0,020	3,3	2,57	0,81	78%
1	SSZ-04, VZ-04	10	90	North	0,943	4,150	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	1	0	1	0,020	3,9	3,06	0,80	79%
36		10	90	North	0,943	4,150	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	0	0	1	0,020	140,9	110,82	0,78	79%
1		10	90	North	0,943	4,150	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	1	0	0	1	0,020	3,9	3,06	0,80	79%
1		10	90	North	0,943	3,050	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	1	1	0	0,020	2,9	2,23	0,82	77%
36		10	90	North	0,943	3,050	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	0	0	1	0	0,020	103,6	80,19	0,79	77%
1		10	90	North	0,943	3,050	39-Fasada S stekleni del N	04ud-fasadna stekla	08ud-S fasada Schuco	0,22	0,50	0,99	0,070	1	0	1	0	0,020	2,9	2,23	0,82	77%
1	SSZ-01	280	90	West	0,978	3,400	43-Fasada Z stekleni del P	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	1	1	1	0,020	3,3	2,61	0,77	78%
28		280	90	West	0,978	3,400	43-Fasada Z stekleni del P	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	0	1	1	0,020	93,1	73,11	0,75	78%
1		280	90	West	0,978	3,400	43-Fasada Z stekleni del P	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	1	0	1	1	0,020	3,3	2,61	0,77	78%
1	SSZ-03 spodaj	280	90	West	1,012	3,100	45-Fasada Z stekleni del B	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	1	0	1	0,020	3,1	2,47	0,76	79%
27		280	90	West	1,012	3,100	45-Fasada Z stekleni del B	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	0	0	1	0,020	84,7	66,62	0,74	79%
1		280	90	West	1,012	3,100	45-Fasada Z stekleni del B	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	1	0	0	1	0,020	3,1	2,47	0,76	79%
1	SSZ-03 zgoraj	280	90	West	1,006	4,100	46-Fasada Z stekleni del B2	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	1	1	0	0,020	4,1	3,29	0,75	80%
14		280	90	West	1,006	4,100	46-Fasada Z stekleni del B2	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	0	0	1	0	0,020	57,8	46,01	0,73	80%
1		280	90	West	1,006	4,100	46-Fasada Z stekleni del B2	04ud-fasadna stekla	10ud-Z fasada Schuco	0,22	0,50	0,81	0,069	1	0	1	0	0,020	4,1	3,29	0,75	80%

Ventilation data

Energy balance calculation with PHPP Version 9.6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Treated floor area A_{TFA}	m²	2390		*('Areas' worksheet)*
Room height h	m	5,96	5,96	
Volume of ventilated space (A_{TFA}*h) V_V	m³	14257		*(Worksheet 'Annual heating')*

Ventilation type

Please select: 1-Balanced PH ventilation with HR

Infiltration air change rate

Wind protection coefficients e and f		
Coefficient e for wind protection class	Several side exposed	One side exposed
No protection	0,10	0,03
Moderate protection	0,07	0,02
High protection	0,04	0,01
Coefficient f	15	20

			For annual demand:	For heating load:				
Wind protection coefficient, e			0,07	0,18				
Wind protection coefficient, f			15	15	Net air volume for press. test	V_{n50}	Air permeability	q_{50}
Air change rate at press. test	n_{50}	1/h	0,60	0,60	14257	m³	1,78	m³/(hm²)

			For annual demand:	For heating load:
Excess extract air		1/h	0,00	0,00
Infiltration air change rate	$n_{V,Real}$	1/h	0,042	0,105

Selection of ventilation input - Results

PHPP offers two methods for dimensioning air quantities and choosing the ventilation unit. With "Standard data input for balanced ventilation", supply or extract air quantities for residential buildings and parameters for ventilation systems with a maximum of 1 ventilation unit can be planned. Projects with up to 10 different ventilation units and air quantities determined according to rooms or zones can be entered in the 'Addl vent' worksheet. Please select your design method here:

	Ventilation unit / Heat recovery efficiency design		Average air flow rate m³/h	Average air change rate 1/h	Extract air excess (extract air system) 1/h	Effective heat recovery efficiency unit [-]	Humidity recovery efficiency [-]	Specific power input Wh/m³	Heat recovery efficiency SHX [-]
x	Standard design	*('Ventilation' worksheet, see below)*	6880	0,48	0,00	78,1%	0,0%	0,20	0,0%
	Multiple ventilation units, non-res	*('Addl vent' worksheet)*							

Cooling recovery:

Efficiency SHX η^*_{SHX}: 0%

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
33%	33%	39%	47%	-	-	-	-	67%	58%	44%	35%

Standard data input for balanced ventilation

Dimensioning of ventilation system with only one ventilation unit

Occupancy	m³/P	16
Number of occupants	P	150,0
Supply air per person	m³/(P*h)	60
Supply air requirement	m³/h	9000
Extract air rooms		
Quantity		
Extract air requirement per room	m³/h	
Total extract air requirement	m³/h	1200

Extract air rooms	Kitchen	Bathroom	Bathroom (shower only)	WC	Wardrobe
Quantity		15		15	15
Extract air requirement per room (m³/h)	60	40	20	20	20

Design air flow rate (maximum) m³/h 8600 Recommended: 9000 m³/h

Average air change rate calculation

Type of operation	Daily operation times h/d	Factors referenced to maximum	Air flow rate m³/h	Air change rate 1/h
maximum	16,0	1,00	8600	0,60
Standard		0,77	6615	0,46
Basic ventilation		0,54	4631	0,32
Minimum	8,0	0,40	3440	0,24
		Average value	Average air flow rate (m³/h) 6880	Average air change rate (1/h) 0,48

Selection of ventilation unit with heat recovery

Location of ventilation unit: 1-Inside thermal envelope

	Go to ventilation units list 1-Sorting: AS LIST	Heat recovery efficiency	Humidity recovery efficiency	Specific efficiency [Wh/m³]	Application [m³/h]	Frost power input
Ventilation unit selection	05ud-Klimati povprečne učinkovitosti vsaj 80%	0,80	0,00	0,20	0 - 33600	N/A

Conductivity outdoor air duct	Ψ	W/(mK)	1,422
Length of outdoor air duct		m	20
Conductivity exhaust air duct	Ψ	W/(mK)	1,422
Length of exhaust air duct		m	20
Temperature of mechanical services room (Enter only if the central unit is outside of the thermal envelope)		°C	20

Implementation of frost protection	3-Hydraul.
Limit temperature [°C]	-3
Useful energy [kWh/a]	3313
Room temperature (°C)	20
Avg. ambient temp. heat. period (°C)	4,9
Avg. ground temp (°C)	11,8

Effective heat recovery efficiency $\eta_{HR,eff}$ **78,1%**

Effective heat recovery efficiency subsoil heat exchanger

SHX efficiency	η^*_{SHX}	0%
Heat recovery efficiency SHX	η_{SHX}	0%

Secondary calculation
Ψ-value supply or outdoor air duct

Nominal width	1500	mm
Insulation thic	100	mm
Reflective coating?	x	Yes
		No
Thermal conductivity	0,035	W/(mK)
Nominal air flow rate	6880 m³/h	
Δϑ	15 K	
Exterior duct diameter	1,500 m	
Exterior diameter	1,700 m	
α-Interior	3,78 W/(m²K)	
α-Surface	2,40 W/(m²K)	
Ψ-value	1,422 W/(mK)	
Surface temperature difference	1,678 K	

Secondary calculation
Ψ-value extract or exhaust air duct

Nominal width:	1500	mm
Insulation thicknes	100	mm
Reflective coating?	x	yes
		no
Thermal conductivity	0,035	W/(mK)
Nominal air flow rate	6880 m³/h	
Δϑ	15 K	
Exterior duct diameter	1,500 m	
Exterior diameter	1,700 m	
α-Interior	3,78 W/(m²K)	
α-Surface	2,40 W/(m²K)	
Ψ-value	1,422 W/(mK)	
Surface temperature difference	1,678 K	

Specific energy for heating (monthly method)

Energy balance calculation with PHPP Version 9.6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

The sum of the heating periods calculated through the monthly method will be presented on this side.

Interior temperature:	20	°C
Building type:	Športni objekt	
Treated floor area A_{TFA}:	2390,2	m²
Spec. Capacity:	204	Wh/(m²K)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Month. red. fac.		G_t kKh/a		kWh/a	Per m² of treated floor area
External wall - Ambient	A	1291,5	*	0,128	*	1,00	*	80	=	13203	5,52
External wall - Ground	B	109,4	*	0,152	*	1,00	*	36	=	602	0,25
Roof/Ceiling - Ambient	A	1328,2	*	0,083	*	1,00	*	80	=	8738	3,66
Floor slab / Basement ceiling	B	1328,2	*	0,138	*	1,00	*	36	=	6623	2,77
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
	X		*		*	0,00	*		=		
Windows	A	733,8	*	0,757	*	1,00	*	80	=	44235	18,51
Exterior door	A	15,2	*	0,987	*	1,00	*	80	=	1198	0,50
Exterior TB (length/m)	A	35,9	*	0,200	*	1,00	*	80	=	571	0,24
Perimeter TB (length/m)	P	145,8	*	0,050	*	1,00	*	36	=	264	0,11
Ground TB (length/m)	B		*		*	1,00	*		=		0,00
										kWh/(m²a)	
Transmission heat losses Q_T									Total	75434	31,6

				A_{TFA} m²		Clear room height m		m²		
		Effective air volume V_V		2390	*	5,96	=	14257		
	$n_{V,system}$ 1/h	η^*_{SHX}		η_{HR}		$n_{V,Res}$ 1/h		$n_{V,equi,fraction}$ 1/h		
Effective air change rate Ambient nV,e	0,483	*(1-	0%	)*(1-	0,78	)+	0,042	=	0,148	
Effective air change rate Ground nV,g	0,483	*	0%	*(1-	0,78	)		=	0,000	
	V_V m²	$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m²K)		G_t kKh/a		kWh/a		kWh/(m²a)
Ventilation losses ambient Q_V	14257	*	0,148	*	0,33	*	80	=	55417	23,2
Ventilation losses ground $Q_{V,e}$	14257	*	0,000	*	0,33	*	47	=	0	0,0
Ventilation heat losses Q_V								Total	55417	23,2

		Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend saving		kWh/a	kWh/(m²a)
Total heat losses Q_L	(	75434	+	55417	)	1,0	=	130850	54,7

Orientation of the area	Reduction factor see 'Windows' worksheet		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0,50	*	0,22	*	287,7	*	144	=	4541
East	0,50	*	0,22	*	189,4	*	348	=	7177
South	0,00	*	0,00	*	0,0	*	546	=	0
West	0,49	*	0,22	*	256,8	*	303	=	8366
Horizontal	0,00	*	0,00	*	0,0	*	509	=	0
Sum opaque areas									4529
									kWh/(m²a)
Available solar heat gains Q_S								Total	24613	10,3

	kh/d		Length Heat. Period d/a		Spec. Power q_i W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0,024	*	242	*	2,8	*	2390,2	=	39009	16,3

			kWh/a	kWh/(m²a)
Free heat Q_F	$Q_S + Q_I$	=	63622	26,6
Ratio free heat to losses	Q_F / Q_L	=	0,49	
Utilisation factor heat gains h_G		=	95%	
			kWh/a	kWh/(m²a)
Heat gains Q_G	$\eta_G * Q_F$	=	60197	25,2

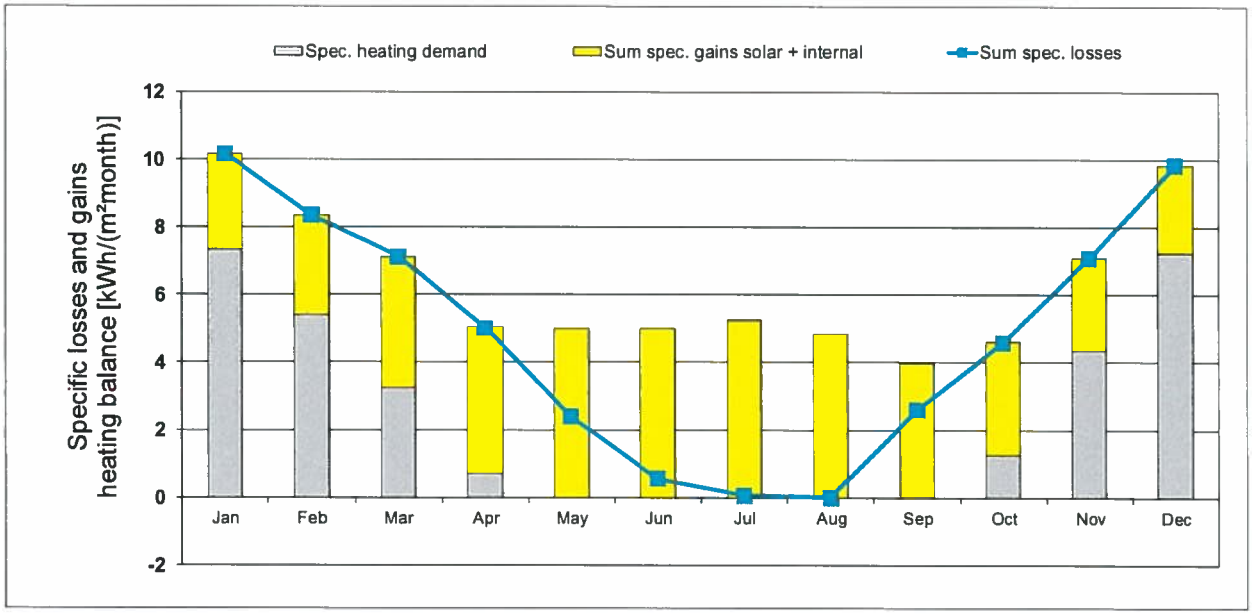
			kWh/a	kWh/(m²a)
Annual heating demand Q_H	$Q_L - Q_G$	=	70653	30
			kWh/(m²*a)	(Yes/No)
Limiting value			-	-
		Requirement met?		

Specific energy for heating (monthly method)

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Interior temperature: 20 °C
Building type: Športni objekt
Treated floor area A_{TFA}: 2390 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Extern	15,0	12,2	10,3	7,1	3,1	0,4	-0,3	-0,4	3,5	6,6	10,4	14,6	83	kKh
Heating degree hours - Ground	5,0	4,7	5,2	4,8	4,6	3,1	2,9	2,7	3,6	3,9	4,2	4,7	50	kKh
Losses - Exterior	23263	18966	15944	10957	4753	679	-450	-584	5425	10175	16096	22535	127759	kWh
Losses - Ground	1042	976	1077	999	958	650	602	564	746	816	861	972	10263	kWh
Sum spec. losses	10,2	8,3	7,1	5,0	2,4	0,6	0,1	0,0	2,6	4,6	7,1	9,8	57,7	kWh/m²
Solar gains - North	282	472	840	1078	1491	1520	1539	1220	800	550	302	215	10310	kWh
Solar gains - East	575	755	1284	1505	1957	1961	2180	1858	1389	822	472	376	15133	kWh
Solar gains - South	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - West	548	826	1350	1944	2316	2414	2529	2339	1640	1092	572	395	17965	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	359	477	770	937	1159	1177	1266	1121	842	563	330	249	9251	kWh
Internal heat gains	4997	4513	4997	4836	4997	4836	4997	4997	4836	4997	4836	4997	58836	kWh
Sum spec. gains solar + intern	2,8	2,9	3,9	4,3	5,0	5,0	5,2	4,8	4,0	3,4	2,7	2,6	46,6	kWh/m²
Utilisation factor	100%	100%	100%	99%	48%	11%	1%	100%	65%	100%	100%	100%	60%	
Annual heating demand	17544	12899	7779	1740	0	0	0	0	1	2972	10445	17276	70653	kWh
Spec. heating demand	7,3	5,4	3,3	0,7	0,0	0,0	0,0	0,0	0,0	1,2	4,4	7,2	29,6	kWh/m²



Annual heating demand: Comparison

Monthly method	('Heating')	70653	kWh/a	29,6	kWh/(m²a) reference to treated floor area according to PHPP
Annual method	('Annual heat	73560	kWh/a	30,8	kWh/(m²a) reference to treated floor area according to PHPP
		-	kWh/a	-	

Month	1	2	3	4	5	6	7	8	9	10	11	12	Annual total	Heating period method
Days	31	28	31	30	31	30	31	31	30	31	30	31	365	188
Ambient Temp.	0,10	2,10	6,50	10,50	16,20	19,70	20,70	20,80	15,40	11,40	5,80	0,70	10,9	4,1
North Radiation	9,0	15,0	26,0	34,0	46,0	47,0	47,0	38,0	25,0	18,0	10,0	7,0	322	94
East Radiation	23,0	32,0	57,0	69,0	92,0	93,0	103,0	86,0	62,0	35,0	19,0	15,0	686	227
South Radiation	61,0	65,0	86,0	83,0	87,0	80,0	89,0	92,0	88,0	71,0	51,0	41,0	894	383
West Radiation	24,0	34,0	54,0	75,0	88,0	91,0	96,0	90,0	65,0	44,0	24,0	17,0	702	191
Horiz Radiation	32,0	50,0	90,0	119,0	155,0	162,0	173,0	146,0	101,0	62,0	32,0	23,0	1145	322
Tsky	-11,20	-10,40	-6,40	-1,90	4,00	8,20	9,20	9,90	5,40	2,60	-3,30	-9,40	-0,2	
Ground Temp	13,22	12,97	13,00	13,29	13,77	15,63	16,09	16,33	14,98	14,69	14,21	13,68	14,3	13,5

Cooling: energy value for useful cooling energy

Energy balance calculation with PHPP Version 9 6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

The sum of the cooling periods calculated through the monthly method will be presented on this side.

Building type	Športni objekt	
Interior temperature summer	25	°C
Nominal humidity	12	g/kg
Spec. capacity	204	Wh/(m²K)

Treated floor area A_{TFA}	2390,2	m²
Building volume	14257	m³
Internal humidity sources	6,3	g/(m²h)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Mon. red. fac.		G_t kKh/a		kWh/a	per m² treated floor area
External wall - Ambient	A	1291,5	*	0,128	*	1,00	*	36	=	6038	2,53
External wall - Ground	B	109,4	*	0,152	*	1,00	*	44	=	728	0,30
Roof/Ceiling - Ambient	A	1328,2	*	0,083	*	1,00	*	36	=	3996	1,67
Floor slab / Basement ceiling	B	1328,2	*	0,138	*	1,00	*	44	=	8010	3,35
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
	X		*		*	0,00	*		=		
Windows	A	733,8	*	0,757	*	1,00	*	36	=	20231	8,46
Exterior door	A	15,2	*	0,987	*	1,00	*	36	=	548	0,23
Exterior TB (length/m)	A	35,9	*	0,200	*	1,00	*	36	=	261	0,11
Perimeter TB (length/m)	P	145,8	*	0,050	*	1,00	*	36	=	266	0,11
Ground TB (length/m)	B		*		*	1,00	*		=		0,00
											kWh/(m²a)
Transmission losses Q_T (negative: heat loads)									Total	40079	16,8

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, vent. unit			Ventilation parameter			Summer ventilation regulation	
exterior $H_{V,e}$	497,9	W/K	Temperature amplitude summer	9,9	K	HRV/ERV in summer	
without HR	2270,4	W/K	Minimum acceptable indoor temperature	22,0	°C	None	
ground $H_{V,g}$	0,0	W/K	Heat capacity air	0,33	Wh/(m²K)	Controlled by temp.	x
without HR	0,0	W/K	Supply air changes	0,48	1/h	Controlled by enthalpy	
Ventilation conductance, others			Outdoor air changes	0,29	1/h	Always	
exterior	1373,8	W/K	Window night vent. air change rate, manual @ 1K	0,00	1/h	Additional ventilation	
			Air changes rate due to mech., autom. controlled vent.	0,00	1/h	Controlled by temp.	
			Specific power consumption for	0,35	Wh/m³	Controlled by humidity	x
			η_{HR}	78%			
			η_{ERV}	0%			
			η^*_{SHX}	0%			

Hygienic air change	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR} (considers bypass)		$n_{V,Rest}$ 1/h		$n_{V,equ.fraction}$ 1/h
Effective air change rate Ambient $n_{V,e}$	0,483	*(1-	0%	)*(1-	0,00	)+	0,292	=	0,772
Effective air change rate Ground $n_{V,g}$	0,483	*	0%	*(1-	0,00	)		=	0,000

	V_V m³		$n_{V,equ.fraction}$ 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a	kWh/(m²a)
Ventilation losses ambient Q_V	14257	*	0,772	*	0,33	*	34	=	124085	51,9
Ventilation losses ground $Q_{V,e}$	14257	*	0,000	*	0,33	*	0	=	0	0,0
Heat losses summer ventilation	14257	*	0,000	*	0,33	*	0	=	0	0,0
Ventilation heat losses Q_V								Total	124085	51,9

	Q_T kWh/a		Q_V kWh/a		kWh/a	kWh/(m²a)
Total heat losses Q_L	40079	+	124085	=	164164	68,7

Orientation of the area	Reduction factor		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0,55	*	0,22	*	287,7	*	243	=	8441
East	0,62	*	0,22	*	189,4	*	526	=	13571
South	0,40	*	0,00	*	0,0	*	519	=	0
West	0,62	*	0,22	*	256,8	*	477	=	16582
Horizontal	0,40	*	0,00	*	0,0	*	856	=	0
Sum opaque areas									6501
									kWh/(m²a)
Available solar heat gains Q_S								Total	45095 / 18,9

	kh/d		Length heat. period d/a		Spec. power q_i W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0,024	*	183	*	2,8	*	2390,2	=	29499	12,3

		kWh/a	kWh/(m²a)
Sum heat loads Q_F	$Q_S + Q_I$ =	74593	31,2
Ratio of losses to free heat gains	Q_L / Q_F =	2,20	
Utilisation factor heat losses η_G	=	44%	
Useful heat losses $Q_{V,n}$	$\eta_G * Q_L$ =	71477	29,9
Useful cooling demand Q_K	$Q_F - Q_{V,n}$ =	3117	1

	kWh/(m²a)		(Yes/No)
Recommended maximum value	15	Requirement met?	Yes

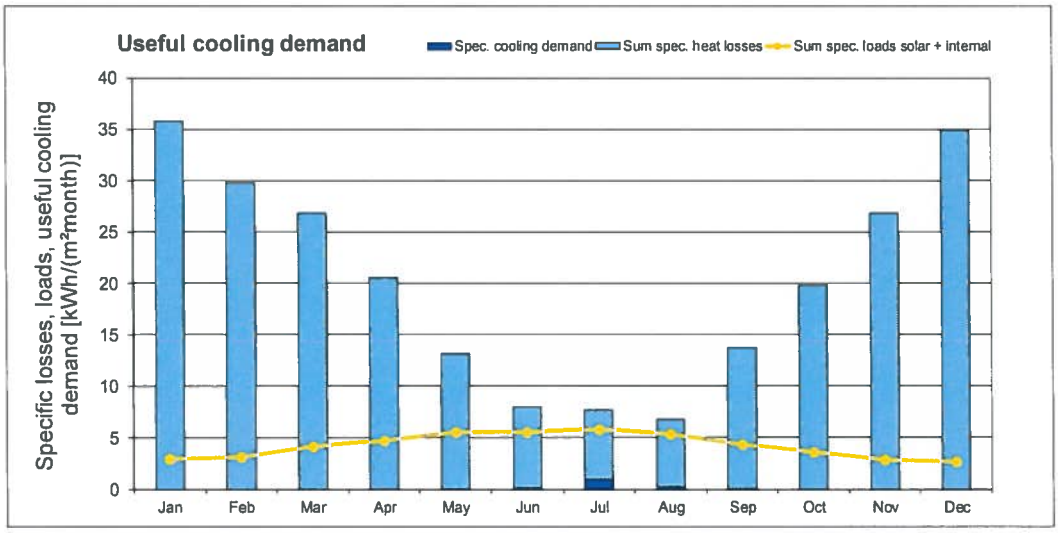
Energy balance calculation with PHPP Version 9.6a

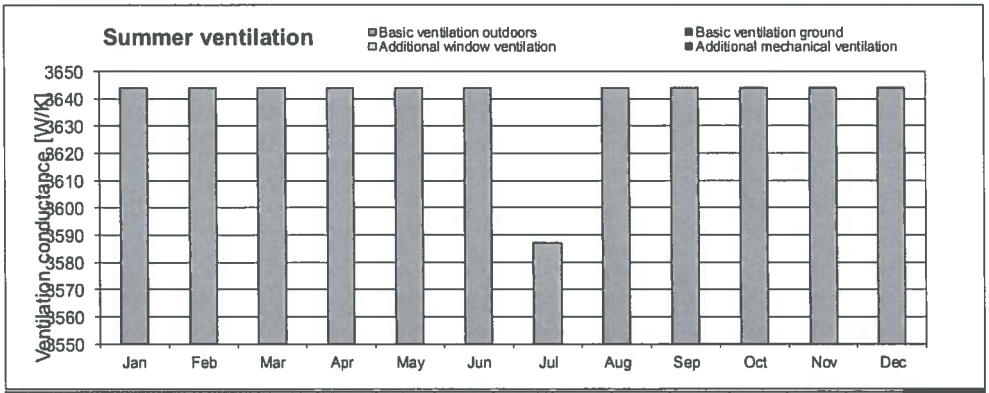
Cooling: energy value for useful cooling energy

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Interior Temperature: 25 °C
Building type: Športni objekt
Treated Floor Area A_{TFA}: 2390 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	18,9	15,8	14,2	10,9	7,0	4,2	3,6	3,5	7,3	10,4	14,1	18,4	128	kKh
Heating degree hours - Ground	8,8	8,1	8,9	8,4	8,4	6,7	6,6	6,4	7,2	7,7	7,8	8,4	93	kKh
Losses - Exterior	83783	69655	62388	47390	29864	17530	14802	14410	31429	45842	62531	81735	561361	kWh
Losses - Ground	1747	1611	1780	1681	1666	1345	1322	1286	1438	1529	1548	1680	18635	kWh
Losses summer ventilation	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Sum spec. heat losses	35,8	29,8	26,8	20,5	13,2	7,9	6,7	6,6	13,8	19,8	26,8	34,9	242,7	kWh/m²
Solar load North	311	521	928	1190	1646	1677	1698	1346	883	607	334	238	11379	kWh
Solar load East	719	944	1606	1882	2448	2452	2727	2324	1737	1028	590	470	18928	kWh
Solar load South	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load West	690	1039	1699	2445	2914	3037	3181	2942	2063	1373	719	497	22598	kWh
Solar load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Opaque	359	477	770	937	1159	1177	1266	1121	842	563	330	249	9251	kWh
Internal heat gains	4997	4513	4997	4836	4997	4836	4997	4997	4836	4997	4836	4997	58836	kWh
Sum spec. loads solar + internal	3,0	3,1	4,2	4,7	5,5	5,5	5,8	5,3	4,3	3,6	2,8	2,7	50,6	kWh/m²
Utilisation factor losses	8%	11%	16%	23%	42%	68%	72%	77%	32%	18%	11%	8%	21%	
Useful cooling energy demand	0	0	0	0	10	272	2247	587	1	0	0	0	3117	kWh
Spec. cooling demand	0,0	0,0	0,0	0,0	0,0	0,1	0,9	0,2	0,0	0,0	0,0	0,0	1,3	kWh/m²
Specif. dehumidification demand	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,0	0,2	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	85%	100%	100%	100%	100%	100%	89%	





Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Days	31	28	31	30	31	30	31	31	30	31	30	31	365
Ambient Temp.	0,10	2,10	6,50	10,50	16,20	19,70	20,70	20,80	15,40	11,40	5,80	0,70	10,87
North Radiation	9,0	15,0	26,0	34,0	46,0	47,0	47,0	38,0	25,0	18,0	10,0	7,0	322,0
East Radiation	23,0	32,0	57,0	69,0	92,0	93,0	103,0	86,0	62,0	35,0	19,0	15,0	686,0
South Radiation	61,0	65,0	86,0	83,0	87,0	80,0	89,0	92,0	88,0	71,0	51,0	41,0	894,0
West Radiation	24,0	34,0	54,0	75,0	88,0	91,0	96,0	90,0	65,0	44,0	24,0	17,0	702,0
Hori. Radiation	32,0	50,0	90,0	119,0	155,0	162,0	173,0	146,0	101,0	62,0	32,0	23,0	1145,0
Dew Point	-2,8	-2,5	0,6	4,3	9,4	12,5	13,8	14,6	10,8	8,1	3,1	-1,7	5,9
Tsky	-11,20	-10,40	-6,40	-1,90	4,00	8,20	9,20	9,90	5,40	2,60	-3,30	-9,40	-0,22
Ground Temp	13,22	12,97	13,00	13,29	13,77	15,63	16,09	16,33	14,98	14,69	14,21	13,68	14,33

Aux Electricity

Plavalni zimski bazen / Climate. Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Treated floor area	2390	m²
Heating period	188	d
Air volume	14257	m³
Dwelling units	1	HH

Heat recovery efficiency ventilation unit	0,78	
Operation vent. system Winter	4,50	kh/a
Operation vent. system Summer	4,26	kh/a
Air change rate	0,48	h⁻¹

Annual space heating demand	30	kWh/(m²a)
Boiler rated power	44	kW
DHW system heating demand	90247	kWh/a
Design forward flow temperature	55	°C

Column no.	1	2	3		4		5		6		7		8		9		10	11
Application	Existing [1/0]	Within the thermal envelope [1/0]	Norm demand		Utilisation factor		Period of operation		Reference size		Electricity demand [kWh/a]		Available as interior heat		Utilisation period [h/a]		Internal heat gains winter [W]	Internal heat gains summer [W]
Ventilation system																		
Winter ventilation	1		0,20	Wh/m³	0,48	h⁻¹	4,5	kh/a	14257	m³	6196		considered in heat recovery efficiency					
Defroster HX	0	1	Data entries in 'Ventilation' worksheet or in 'Addl vent'								0		0,2	/	4,50	=	0	
Summer ventilation	1	0,90	0,20	Wh/m³	0,48	h⁻¹	4,3	kh/a	14257	m³	5858		1,0	/	4,26	=		1238
													Internal heat sources 'Additional summer ventilation'					0,0
Additional vent. summer	0	0,90	0,35	Wh/m³	0,00	h⁻¹	4,3	kh/a	14257	m³	0		1,0	/	4,26	=		0,0
Heating system					Controlled / non controlled [1/0]													
Enter the rated power of the pump				W	1													
Circulator pump heating	1	1	309	W	0,7		4,5	kh/a	1		999		1,0	/	4,50	=	222	
Boiler electricity consumption at 30% load				W														
Aux. energy - Heat. boiler	1	0	92	W	1,00		4,72	kh/a	1		435		1,0	/	4,50	=	0	
Aux. energy - Wood fired/Pellet boiler	0	0	Data entries in 'Boiler' worksheet. Aux. energy demand including possible drinking water production								0		1,0	/	4,50	=	0	
DHW system																		
Enter average power consumption of pump				W														
Circulation pump DHW	1	1	52	W	1,00		7,9	kh/a	1		409		1,0	/	8,76	=	47	47
Enter the rated power of the pump				W														
Storage load pump DHW	1	1	227	W	1,00		2,1	kh/a	1		466		1,0	/	8,76	=	53	53
Boiler electricity consumption at 100% load				W														
DHW boiler aux. energy	1	0	277	W	1,00		1,0	kh/a	1		282		1,0	/	8,76	=	0	0
Enter the rated power of the solar DHW pump				W														
Solar aux. electricity	1	0	185	W	1,00		1,8	kh/a	1		324		1,0	/	8,76	=	0	0
Aux. electricity cooling and dehumidification																		
Aux. electricity cooling				kWh/a	1,00		1,0		1		0		1,0	/	4,26	=		0
Aux. electricity dehum.				kWh/a	1,00		1,0		1		0		1,0	/	4,26	=		0
Misc. aux. electricity																		
Misc. aux. electricity				kWh/a	1,00		1,0		1		0		1,0	/	8,76	=	0	0
Total											14969						322	1338
Specific demand	kWh/(m²a) (treated floor area)										6,3							

Electricity demand for non-residential buildings

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating: 29,6 kWh/(m²a) / Cooling: 1,5 kWh/(m²a) / PER: 103,7 kWh/(m²a)

Treated floor area A_{EA}	2390,2	m²
Auxiliary electricity demand	14969,4	kWh/a

	PER factors:	PE factors:	
Electricity	1,30	2,5	kWh/kWh
RE gas / Natural gas	1,75	1,1	kWh/kWh
Energy carrier for DHW			kWh/kWh
Solar fraction of DHW	42%		
Marginal performance ratio DHW			

Window properties (from 'Windows' worksheet):

	Shading	Dirt factor	Non-perpendicular incidence	Glazing fraction
North	0.78	0.95	0,85	0,79
East	0,77			0,79
South	1,00			0,00
West	0.77			0,79

Lighting / non-residential Room / Zone	Net ground area m²	Room category	Power of nominal lighting Lux 15	Facade with windows: Deviation from North Degrees	Orientation	Light transmission glazing -	Window existing? [-]	Geometry input of a typical room: Room depth m	Room width m	Room height m	Lintel height m	Window width m
uporabniški del	597,5	1-uporabniški del	300	0	North	69%	x	26,5	27,0	7,5	7,4	26,5
uporabniški del	597,5	1-uporabniški del	300	90	East	69%	x	13,5	53,0	7,5	7,4	13,5
uporabniški del	597,5	1-uporabniški del	300	180	South	69%	x	26,5	27,0	7,5	7,4	26,5
uporabniški del	597,5	1-uporabniški del	300	270	West	69%	x	13,5	53,0	7,5	7,4	13,5

Daylight utilisation	User data: Installed lighting power W/m²	Installed lighting power (standard) W/m²	Lighting control	Motion detector used? [x]	Lighting check		Utilisation hours per year h/a	User determined Lighting full load hours h/a	Full load hours of lighting h/a	Electricity demand kWh/a	Spec. electricity demand kWh/(m²a)
Medium	4	4,0	4	x	Bus system	With motion detector	3000		1547	3698	0,2
Low	4	4,0	4	x	Bus system	With motion detector	3000		1588	3795	0,2
None	4	4,0	4	x	Bus system	With motion detector	3000		2399	5734	0,6
Low	4	4,0	4	x	Bus system	With motion detector	3000		1560	3729	0,2
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					
None		0,0			Manual	Without motion detector					

Office equipment	Room category 2	Within the thermal envelope [1/0]	Existing [1/0]		Quantity		Power consumption [W]		Utilisation hours per year [h/a] 5	20	Relative absenteeism 18			Duration of utilisation in energy saving mode [h/a]		Useful energy [kWh/a]		Electricity demand [kWh/a]
PC 1	2-ostalo	1	1	*	2	*	80	*(	3000	*(1-	0,95	)			=	24	=	24,0
PC in energy saving mode		1			2	*	2,0	*	3000	*	0,95				=	11	=	11,4
Monitor 1	2-ostalo	1	1	*	2	*	28	*(	3000	*(1-	0,95	)			=	8	=	8,4
Monitor in energy saving mode		1			2	*	2,0	*	3000	*	0,95				=	11	=	11,4
PC 2	1-uporabniški del	1	1	*	2	*	80	*(	3000	*(1-	0,1	)			=	432	=	432,0
PC in energy saving mode		1			2	*	2,0	*	3000	*	0,1				=	1	=	1,2
Monitor 2	1-uporabniški del	1	1	*	2	*	28	*(	3000	*(1-	0,1	)			=	151	=	151,2
Monitor in energy saving mode		1			2	*	2,0	*	3000	*	0,1				=	1	=	1,2
Copier		1	0	*		*	400	*(	0				-	2475	)=	0	=	0,0
Copier in energy saving mode		1			0	*	30	*	2475						=	0	=	0,0
Printer	1-uporabniški del	1	1	*	2	*	150	*(	3000				-	2475	)=	158	=	157,5
Printer in energy saving mode		1			2	*	2	*	2475						=	10	=	9,9
Server	2-ostalo	1	1	*	1	*	100	*(	3000						=	300	=	300,0
Server in energy saving mode		1			1	*	2,0	*(	8760				-	3000	)=	12	=	11,5
Telephone system				*		*		*	8760						=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0

Kitchen / Aux. electricity	Room category (predominant utilisation pattern of building)	Within the thermal envelope [1/0]	Existing [1/0]		Days of utilisation per year [d/a] 8		Number of meals per day of use		Norm consumption		Useful energy [kWh/a]		Non-electric fraction	Electric fraction		Additional demand		Marginal performance ratio		Solar fraction		Non-electric demand [kWh/a]	Electricity demand [kWh/a]
									kWh / Meal														
Cooking		1	1	*	0	*		*	0,25	=	0	*		100%							=		0,0
1-Electricity									kWh / Cycle			*	0%								=	0	
Dishwashing		1	1	*	0	*	0	*	0,10	=	0	*		100%							=		0,0
2-Cold water connection									kWh/d			*	0%		*(1+	0,30	)*	1,20	*(1-	0,42	)=	0	
Refrigerating					365					=	0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
Total auxiliary electricity											14969												14969,4

	Useful energy		Hot water non-electric dishwashing	Non-electric demand	Electricity demand	
Total	32954	kWh	0	0,0	32954	kWh/a kW
Specific demand			0,0	0,0	14	kWh/(m²a) kW

Internal heat gains for non-residential buildings

Energy balance calculation with PHPP Version 9.6a

Plavalni zimski bazen / Climate: Ljubljana - referenčno / TFA: 2390 m² / Heating 29.6 kWh/(m²a) / Cooling 1.5 kWh/(m²a) / PER: 103.7 kWh/(m²a)

Utilisation: 22-Other — IHG 2,81 W/m²

Type of values used: 4-PHPP calculation ('IHG non-res' worksheet)

2,81 W/m²

Enter here results from cell above: 2,81 W/m²

Persons: 150,0 P

Treated floor area: 2390,19 m²

Heating period: 188 d/a

Room temperature: 20 °C

Internal heat gains aux. electricity: 322 W

Persons	Selection of user profile	Select	Activity of persons	Planning 0 = according to ground area or usable zone 1 = according to occupancy		Number of occupants		Ground area of useful zone [m²]		Average occupancy [Pers./m²]		Heat emitted per person [W]		Utilisation hours per year [h/a]		Relative presence		Utilisation period [h/a]		Average heat release persons [W]
										27				9		18				
Persons A	1-upravljalki del	3	>10 yr., standing or light work	1	Planning with occupancy	140	or			0,086197464		100		3000		0,90		8760		4315
Persons B	2-ostalo	3	>10 yr., standing or light work	1	Planning with occupancy	10	or			0,015384615		100		3000		0,05		8760		17
Persons C		2	> 10 yr., sitting	1			or			Not a standard value		80		0		1,00		8760		0
Persons D		2	> 10 yr., sitting	1			or			Not a standard value		80		0		1,00		8760		0
Persons E		2	> 10 yr., sitting	1			or			Not a standard value		80		0		1,00		8760		0
Persons F		2	> 10 yr., sitting	1			or			Not a standard value		80		0		1,00		8760		0
Persons G		2	> 10 yr., sitting	1			or			Not a standard value		80		0		1,00		8760		0
Evaporation (person specific)						141						0		3000		0,90		8760		0

Lighting / Equipment / Aux. electricity	Useful energy [kWh/a]	Availability	Utilisation period [h/a]	Average heat release
Lighting	16865	1	8,76	1925
Office applications (within therm. envelope)	1120	1	8,76	128
Cooking (within therm. envelope)	0	0,5	8,76	0
Dishwashing (within therm. envelope)	0	0,3	8,76	0
Cooling (within therm. envelope)	0	1	8,76	0
Other (within thermal envelope)	0	1	8,76	0
Auxiliary appliances (see 'Aux Electricity' worksheet)				322

Heat loss due to cold water (calculation from column AJ)	On/Off [1 / 0]	Predominant utilisation pattern of building (Data transferred from 'Electricity non-res' work sheet: input)	Number of WCs (user data)	Amount of WCs: Utilisation of standard values for schools?	Number of WCs (calculation value)	DT Cold water temp. Room temp. [K]	Occupied days per year [d/a]	Loss daytime [W]	Loss night-time [W]	Availability	Utilisation period [d/a]	Average power cold water
Cold water due to flushing WC	1		30		30	-8,2	0	0	-93	1	365	0

Total IHG	W	6707
Specific IHG	W/m²	2,8
Heat available from internal sources	kWh/(m²a)	13

188 d/a

4.3. TOPLOTNA OSKRBA IZ ENERGIJSKO UČINKOVITEGA SISTEMA DO

MESTNA OBČINA NOVA GORICA, Trg E. Kardelja 1, 5000 Nova Gorica, ki jo zastopa župan Matej Arčon, v nadaljnjem besedilu: naročnik
matična številka: 5881773, davčna številka: SI 53055730

in

E3, Energetika, Ekologija, Ekonomija, d.o.o., ki jo zastopa direktor Darko Pahor, matična številka 2010593000, ID za DDV: SI 17851262, v nadaljevanju: dobavitelj

sklepata naslednjo

E 3. d.o.o. | Videl:
Prejeto: 04 -05- 2018
Številka: 0 1 2 3 4 5 6

POGODBA O DOBAVI TOPLOTE

UVODNE DOLOČBE

1. člen

Pogodbeni stranki uvodoma ugotavljata, da:

- naročnik namerava izvesti projekt »Izgradnja pokritega bazena v Novi Gorici« skladno s projektno dokumentacijo PGD št. 01/17, maj 2017 ki jo je izdelal Studio Galeb d.o.o.(PGD projektna dokumentacija);
- je za objekt zimskega bazena iz prejšnje alineje predvideno tudi daljinsko ogrevanje s toplo vodo, kar izhaja tudi izhaja iz PGD projektne dokumentacije ter, da je tovrstna oblika ogrevanja iz tehničnih razlogov in ekonomskega vidika, edina možna;
- je dobavitelj edini ponudnik ogrevanja s toplo vodo, kar izhaja tudi iz dopisa Javnega podjetja KENOG, opr. št. III/6-16/2017 z dne 13.12.2017;
- je bil za predmet te pogodbe izveden postopek s pogajanji brez predhodne objave št. 430-39/2017 v katerem je dobavitelj podal ponudbo št. 1/2018 z dne 2.3.2018 (v nadaljevanju: ponudba);
- so sredstva za predmet te pogodbe za leto 2018 predvidena v Odloku o proračunu Mestne občine Nova Gorica v NRP za leto 2020 – OB 084-13-0118 na proračunski postavki z št. 10.169;
- predviden strošek za trimesečno poskusno obratovanje je predviden v letu 2020, kasneje strošek prevzame upravljalec Javni zavod za šport Nova Gorica;

PREDMET POGODBE

2. člen

S to pogodbo naročnik naroča, dobavitelj pa prevzame obveznost dobave toplote v predvideni okvirni količini 560 MWh letno za obdobje 10 let od pričetka dobave toplote, predvidoma v obdobju od 1.3.2020 do 1.3.2030.

Količine predvidene kupljene toplote za naročnika niso obvezujoče, dobavitelj pa bo moral zagotavljati nakup in prodajo toplote pod enakimi pogoji kot izhajajo iz ponudbe tudi za večje ali manjše količine od predvidenih. V primeru, da so odstopanja odjema večja od +/- 30% od predvidenih ima dobavitelj pravico do prilagoditve izhodiščne ponudbene cene. Prilagoditev cene se definira na podlagi istih parametrov, kot ponujena izhodiščna cena. V primeru spremembe cen pogodbeni stranki skleneta aneks k tej pogodbi.

Dobavitelj se obvezuje dobavljati, naročnik pa prevzemati toploto skladno z določili te pogodbe za odjemno mesto:

Agencija za energijo

ENERGETSKO UČINKOVITI SISTEMI DALJINSKEGA OGREVANJA IN HLAJENJA 2018

Seznam energetsko učinkovitih in neučinkovitih distribucijskih sistemov daljinskega ogrevanja in hlajenja (322. člen Energetskega zakona (EZ-1), Uradni list RS, 17/14, 81/15).

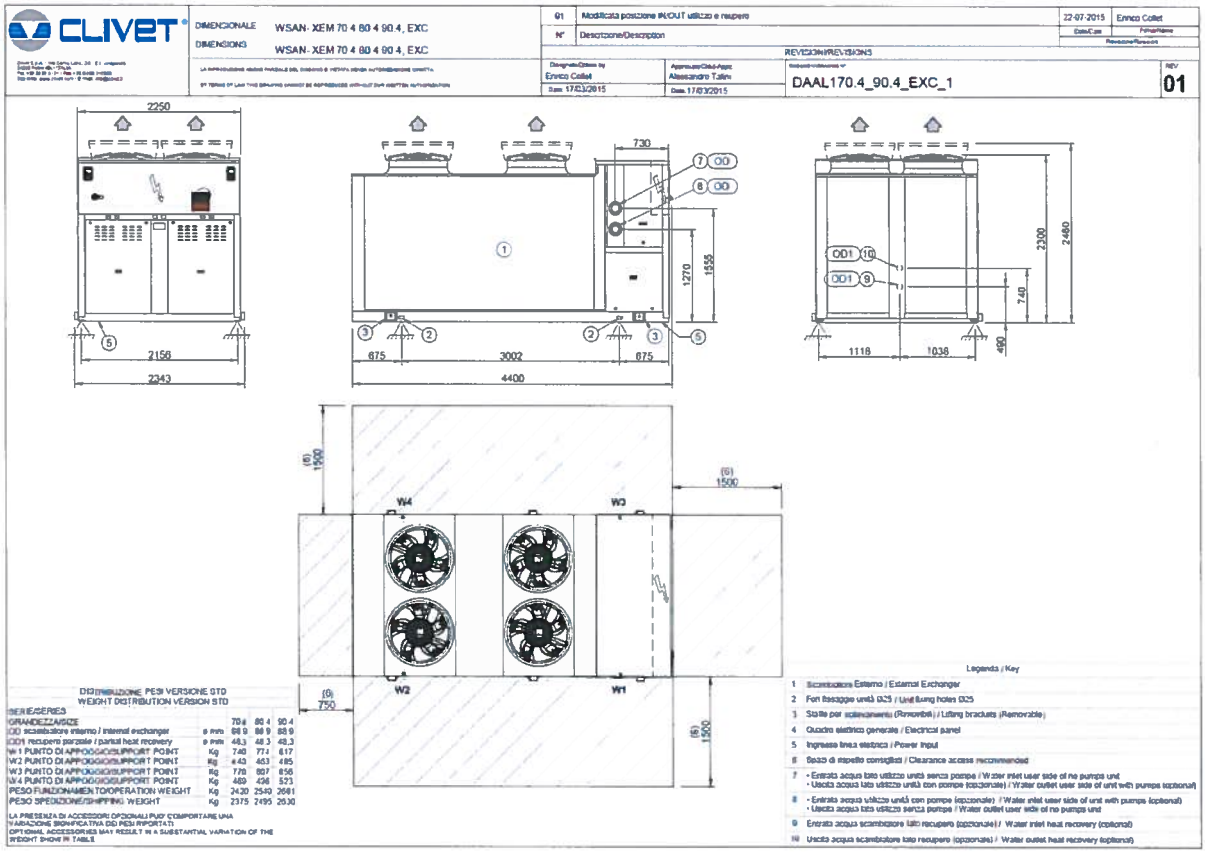
Seznam prikazuje energetsko učinkovite sisteme daljinskega ogrevanja in hlajenja ki so v letu 2018 izpolnili vsaj en izmed kriterij prvega odstavka 322. člena Energetskega zakona (EZ-1), Uradni list RS, 17/14, 81/15, glede na obvezno uporabo obnovljivih virov energije, soproizvodnje in odvečne toplote v sistemih daljinskega ogrevanja in hlajenja.

UPORABLJENE OZNAKE

SDO - Distribucijski sistem daljinskega ogrevanja
SDOLB - Distribucijski sistem daljinskega ogrevanja na lesno biomaso
SDH - Distribucijski sistem hlajenja
PADS - Parovodni distribucijski sistem

ENERGETSKA UČINKOVITOST / VRSTA SISTEMA DALJINSKEGA OGREVANJA / OBMOČJE IZVAJANJA DEJAVNOSTI (OBČINA) / NAZIV DISTRIBUCIJSKEGA SISTEMA
Učinkovit distribucijski sistem daljinskega ogrevanja (322. člen EZ-1)
Mestna občina Celje
Vročevodni/toplovodni distribucijski sistem
SDO Celje
Mestna občina Kranj
Vročevodni/toplovodni distribucijski sistem
SDO Gospodarska cona Iskra Labore, Kranj
Mestna občina Ljubljana
Parovodni distribucijski sistem
Parovod - TO Šiška, Ljubljana
Vročevodni/toplovodni distribucijski sistem
SDO Ljubljana
Mestna občina Nova Gorica
Vročevodni/toplovodni distribucijski sistem
SDOLB Majske poljane, Nova Gorica

4.4. TOPLOTNA ČRPALKA / HLADILNI AGREGAT



Technical Bulletin
BT15D006GB-07

ELFOEnergy Magnum - Heat pump

Air-water heat pump for outdoor installation

WSAN-XEM 50.4 - 120.4 RANGE

Nominal heating capacity (A7/W45) from 155 kW to 378 kW
Nominal cooling capacity (A35/W7) from 139 kW to 321 kW

- **R-410A MODULAR SCROLL TECHNOLOGY**
- **TWO INDEPENDENT REFRIGERATION CIRCUITS**
- **EUROVENT CLASS A IN HEATING**
- **PARTIAL RECOVERY OF THE CONDENSING HEAT (OPTIONAL)**
- **AXITOP FAN (optional for size 70.4 - 120.4)**
  Silent operation and reduced fan consumptions
- **ECOBREEZE FANS (optional for size 70.4 - 120.4)**
  For a further increase in efficiency
- **VARYFLOW + (optional)**
  Variable water flow-rate with inverter pumps

Clivet is taking part in the EUROVENT certification programme up to 1.500 kW. The products concerned appear in the certified products list of the EUROVENT www.eurovent-certification.com site.

CLIVET

General technical data

Size			50.4	55.4	60.4	65.4	70.4	80.4	90.4	100.4	110.4	120.4
Cooling												
Cooling capacity	1	kW	139	149	160	170	184	209	236	275	297	324
Compressor power input	1	kW	43,3	48,2	52,8	58,2	60,4	69,4	85,2	86,7	98,3	114
Total power input	2	kW	48,2	53,1	57,7	63,1	66,8	75,8	91,6	96,4	108	124
EER	1		2,89	2,81	2,78	2,70	2,76	2,76	2,58	2,85	2,75	2,62
Water flow-rate	1	l/s	6,66	7,12	7,66	8,13	8,81	10,0	11,3	13,1	14,2	15,5
User side exchanger pressure drops	1	kPa	17,1	19,4	22,3	20,8	13,8	17,4	21,7	22,1	17,2	20,2
Cooling capacity (EN14511:2013)	3	kW	139	148	160	170	184	208	235	273	296	321
Total power input (EN14511:2013)	3	kW	48,7	53,6	58,4	63,7	67,6	77,0	92,7	98,1	110	126
EER (EN 14511:2013)	3		2,85	2,76	2,73	2,66	2,72	2,70	2,54	2,79	2,69	2,55
SEER	9		3,99	4,00	4,04	4,07	3,94	4,08	4,08	3,93	3,91	3,85
Heating												
Heating capacity	4	kW	154	166	181	193	209	238	273	312	338	374
Compressor power input	4	kW	42,3	46,5	50,7	54,3	57,8	66,6	77,4	85,7	93,5	106
Total power input	2	kW	47,2	51,4	55,6	59,2	64,2	73,0	83,6	95,4	103	115
COP	4		3,26	3,23	3,26	3,26	3,26	3,26	3,27	3,27	3,28	3,24
Water flow-rate	4	l/s	7,36	7,93	8,65	9,22	9,99	11,4	13,0	14,9	16,1	17,9
User side exchanger pressure drop	4	kPa	20,6	23,9	28,4	26,1	17,3	22,2	28,3	28,2	21,8	26,8
Heating capacity (EN14511:2013)	5	kW	155	167	183	194	210	239	274	313	340	378
Total power input (EN14511:2013)	5	kW	47,9	52,3	56,5	60,1	65,3	74,3	85,1	97,5	106	118
COP (EN 14511:2013)	5		3,24	3,20	3,24	3,23	3,22	3,22	3,22	3,21	3,21	3,20
SCOP - AVERAGE Climate - W35	9		3,70	3,66	3,72	3,72	3,64	3,64	3,76	3,25	3,70	3,80
Compressor												
Type of compressors			SCROLL									
Refrigerant			R-410A									
No. of compressors		No	4	4	4	4	4	4	4	4	4	4
Std Capacity control steps		No	6	5	4	5	6	6	6	6	6	4
Oil charge (C1)		l	7,00	7,00	7,00	7,00	8,00	10,0	10,0	11,0	13,0	13,0
Oil charge (C2)		l	7,00	7,00	7,00	8,00	8,00	10,0	10,0	11,0	13,0	13,0
Tot. refrigerant charge (C1)		kg	20,0	26,0	24,0	28,0	29,0	34,0	43,0	46,0	48,0	52,0
Tot. refrigerant charge (C2)		kg	20,0	26,0	24,0	28,0	29,0	34,0	43,0	46,0	48,0	52,0
Refrigeration circuits		No	2	2	2	2	2	2	2	2	2	2
Internal exchanger												
Type of internal exchanger	6		PHE									
No. of internal exchangers		No	1	1	1	1	1	1	1	1	1	1
Water content		l	20,0	20,0	20,0	22,0	30,0	30,0	30,0	36,0	46,0	46,0
External Section Fans												
Type of fans	7		AX									
Number of fans		No	8	8	8	8	4	4	4	6	6	6
Standard airflow		l/s	20300	20300	20000	20000	25000	24200	24200	35000	35000	35000
Installed unit power		kW	0,60	0,60	0,60	0,60	1,90	1,90	1,90	1,90	1,90	1,90
Connections												
Water fittings			3"	3"	3"	3"	3"	3"	3"	4"	4"	4"
Water circuit												
Max water side pressure		KPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Safety valve calibration		kPa	600	600	600	600	600	600	600	600	600	600
Min. installation water contents	8	l	864	841	1240	1227	1245	1233	1176	1618	2005	2505
Power supply												
Standard power supply		V	400/3/50+N	400/3/50+N	400/3/50+N	400/3/50+N	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50

The Product is compliant with the Erp (Energy Related Products) European Directive. It includes the Commission delegated Regulation (EU) No 811/2013 (rate heat output ≤70 kW at specified reference conditions) and the Commission delegated Regulation (EU) No 813/2013 (rated heat output ≤400 kW at specified reference conditions).
(Contains fluorinated greenhouse gases (GWP 2087,5)

1. Data referred to the following conditions: Internal exchanger water temperature = 12/7°C. Entering external exchanger air temperature = 35°C
2. The total Power Input value does not take into account the part related to the pumps and required to overcome the pressure drops for the circulation of the solution inside the exchanger
3. Data compliant to Standard EN 14511:2013 referred to the following conditions: - Internal exchanger water temperature = 12/7°C - Entering external exchanger air temperature = 35°C
4. Data referred to the following conditions: Internal exchanger water temperature = 40/45°C. Entering external exchanger air temperature = 7°C D.B./6°C W.B
5. Data compliant to Standard EN 14511:2013 referred to the following conditions: - Internal exchanger water temperature = 40/45°C - Entering external exchanger air temperature = 7°C. D.B. / 6°C W.B.
6. PHE = plate exchanger
7. AX = axial fan
8. The minimum system water content calculated value does not consider the internal exchanger water content. With outdoor air low temperature applications or low medium requested loads, the minimum installation water volume is obtained doubling the indicated value
9. Data calculated according to the EN 14825:2016 Regulation

4.5. TERMIČNI SOLARNI SISTEM

3.4 Tehnički podaci

3.4.1 Podaci o odobrenjima

Solarni KEYMARK broj registracije (DIN CERTCO)	011-7S1271 F
Izvještaj o ispitivanju prema EN12975 (ITW)	09COL847OEM01
Osnovne norme	EN 12975-1: 2006 EN 12975-2: 2006

3.4.2 Hidraulički podaci

	K3	K4
Nazivno volumno strujanje kod 30 l/hm²	70 l/h	70 l/h
Gubitak tlaka (vezan na nazivno volumno strujanje)	147 mbara	153 mbara

3.4.3 Uvjeti okoline

Temperatura u radu	-30 °C ... +120 °C
Temperatura kod transporta/skladištenja	+10 °C ... +50 °C
relativna vlažnost zraka u transportu/skladištenju	maks 60 %

3.4.4 Snaga

Toplinski kapacitet bez nosioca topline	15,7 kJ/K
Toplinski kapacitet sa nosiocem topline	20,9 kJ/K
Toplinska snaga	1897 W

3.4.5 Stupanj djelovanja

Prema DIN EN 12975, vezano za površinu upijanja:

Stupanj korisnosti eta 0	0,814
a1	3,527 W/m²K
a2	0,012 W/m²K²

3.4.6 Radni tlak

Radni i ispitni tlak	maks 6 bara

3.4.7 Radna temperatura

Temperatura mirovanja (1000 W/m², 30°C)	196°C

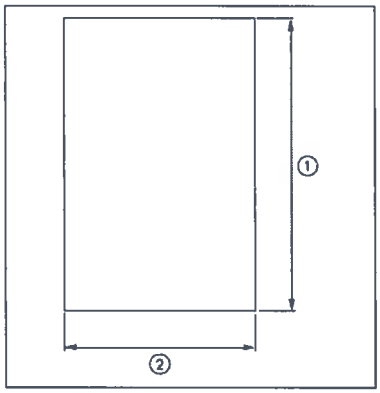
3.4.8 Opterećenje vjetra i snijega

Najveći udar vjetra (okomito na površinu krova).	1,4 kN/m²
Najveći pritisak snijega i udara vjetra (okomito na površinu krova)	1,4 kN/m²

3.4.9 Sadržaj

	K3	K4
Sadržaj medija, nosioca topline	1,72 litara	1,42 litara
tip nosioca topline	Tyfocor L 45 %	Tyfocor L 45 %

3.4.10 Dimenzije

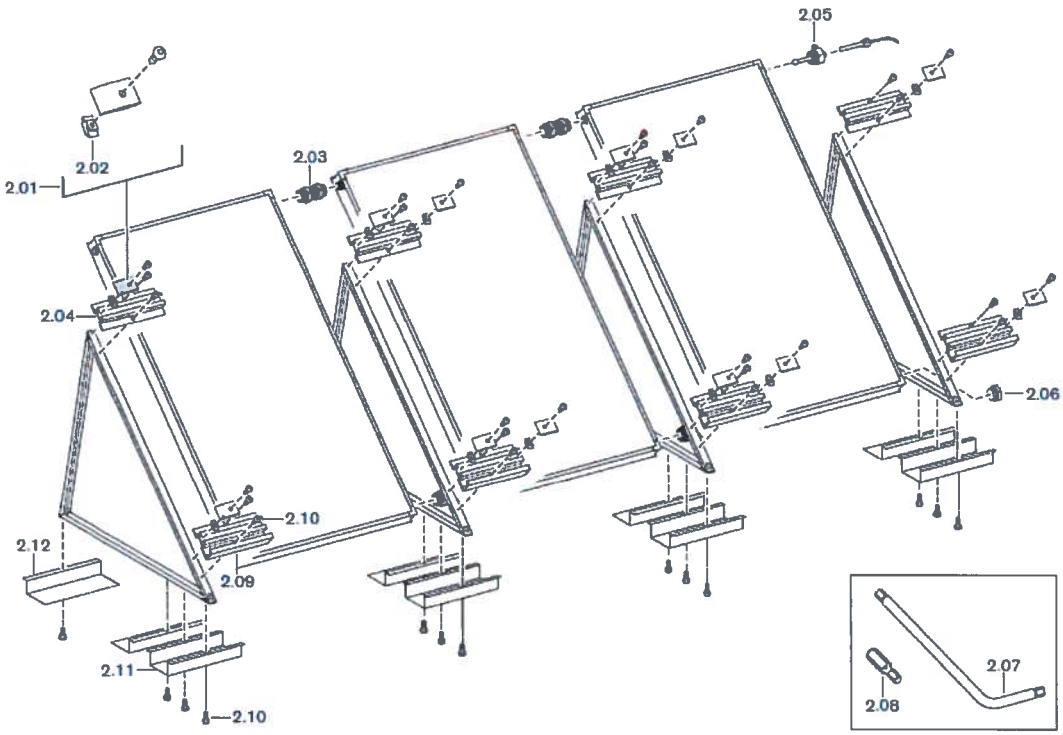


	K3	K4
Brutto površina	2,51 m²	2,51 m²
Površina apsorbera	2,31 m²	2,31 m²
Površina upijanja	2,33 m²	2,33 m²
① Dužina	1212 mm	2070 mm
② Širina	2070 mm	1212 mm
Visina	99 mm	99 mm

3.4.11 Težina

Težina praznog: ca. 40 kg

9 Rezervni dijelovi

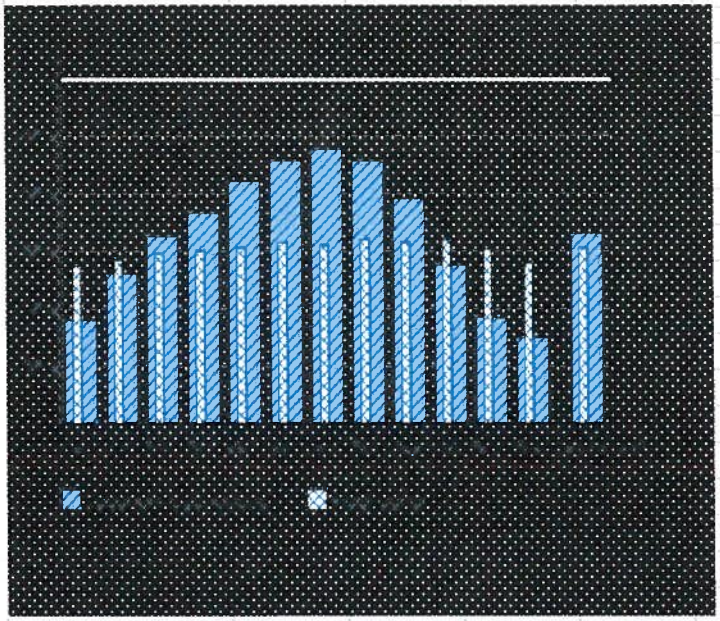


Solarberater - 4.0 - Energiebilanz

Projekt:	NOVA GORICA KOPALIŠČE	
Standort:	Gorizia	geogr. Breite: 45,9°
Kollektor:	65,24 m²	Weishaupt WTS-F2 K4
Kennlinie:	n0 = 0,814	a1 = 3,527 W/(m²·K) a2 = 0,0120 W/(m²·K
Neigung:	45,0°	Südabweichung: 0,0°
Anlagentyp:	WAS + WASol	
Speicher 1:	3600 Liter	Temperatur : max. 95°C
	min. 47°C	
Speicher 2:	3500 Liter	max. 95°C
Wärmebedarf:	244,23 kW	4200 Liter/Tag von 10°C auf 60°C

Monat	Solar-ertrag [kWh]	Ein-strahlung [kWh]	Nach-heizung [kWh]	Deckungs-rate [%]	Wirkungs-grad [%]
Januar:	2765	4990	4925	36	55
Februar:	3696	6510	3502	52	57
März:	4978	8472	2741	65	59
April:	5480	9194	2046	73	60
Mai:	6494	10566	1350	84	61
Juni:	6862	10932	746	91	63
Juli:	7450	12019	466	95	62
August:	7083	11031	721	91	64
September:	5823	9208	1596	78	63
Oktober:	4253	6600	3446	55	64
November:	2749	4510	4703	37	61
Dezember:	2212	3924	5190	30	56
Summe:	59845	97958	31433	66	61

Spezifischer Kollektor-Jahresertrag: 917 kWh/m²



4.6. KLJUČNA DOKAZILA ZA ENERGIJSKO UČINKOVITOST USTREZNIH KOMPONENT

Na tem mestu ter nadaljnjih poglavjih projektant in investitor preverita in po potrebi vstavita/zamenjata dokazila za komponente, ki morajo biti skladne z minimalnimi zahtevami, izpostavljenimi v izračunu novogradnje. S temi prilogami se dopolni dokumentacija za kandidiranje na Eko skladu.

4.7. PRIMERI DOKAZIL ZA USTREZNO ZUNANJE STAVBNO POHIŠTVO

- dokazila o toplotnih karakteristikah zunanjega stavbnega pohištva (okna, fiksne zasteklitve, vrata), skladno s standardom SIST EN 14351-1:2006+A1:2010, iz katerega morajo biti razvidni podatki o toplotni prehodnosti celotnega zunanjega stavbnega pohištva (Uw), zasteklitve (Ug) in profila (Uf), podatki o linijski toplotni upornosti distančnika v zasteklitvi (ψ) in geometrijski podatki profila in zasteklitve;

4.7.1. Zasteklitve

SunGuard® eXtra Selective

SNX 50 / SNX 50 Ultra

The latest addition to the Guardian SunGuard® eXtra Selective (SNX) range is SunGuard® SNX 50, a new triple silver coated solar control glass, which offers even better colour consistency and enhanced internal reflections. In terms of aesthetics and performance, SNX 50 is one of the best solar control glass products currently available in the industry today.

SNX 50 is designed to be optimally applied on either Guardian ExtraClear® float glass (SNX 50) or Guardian UltraClear® low-iron float glass (SNX 50 Ultra). Although both substrates offer the same enhanced aesthetics, SNX 50 Ultra provides exceptional clarity and a crystal-like appearance.

SNX 50 has a highly desirable, consistent, neutral, transparent appearance – regardless of the viewing angle. Internal coloured reflection has been optimised, adding a much more neutral tone to the glass when viewed from the inside of the building.

SNX 50 lets in 50% of natural daylight combined with just 24% of the solar heat – one of the highest selectivity (ratio of light transmission to solar factor) products on the market. SNX 50 is available in annealed and heat treatable versions (SNX 50 HT / SNX 50 HT Ultra) and as laminated glass for safety, security or acoustic applications.

	Visible Light				Solar energy			Solar factor (g)	U-Value (EN 673)
	Transmission [%]	Reflection outside [%]	Reflection inside [%]	Colour rendering index	Direct transmission [%]	Reflection outside [%]	Absorption [%]	EN 410 [%]	Argon 90% [W/m²K]
SNX 50	Double Glazing 6-16-4, SunGuard eXtra Selective on #2								
Annealed	50	10	13	90	22	36	42	24	1.0
Heat Treatable	50	11	14	90	22	37	41	24	1.0
SNX 50	Triple Glazing 6-16-4-16-4, SunGuard eXtra Selective on #2, ClimaGuard® Premium2 on #5								
Annealed	45	11	16	89	20	37	44	22	0.5
Heat Treatable	45	10	17	89	20	38	43	22	0.5
SNX 50 Ultra	Double Glazing 6-16-4, SunGuard eXtra Selective on #2*								
Annealed	50	10	12	91	22	42	35	24	1.0
Heat Treatable	50	11	14	92	23	43	34	24	1.0
SNX 50 Ultra	Triple Glazing 6-16-4-16-4, SunGuard eXtra Selective on #2, ClimaGuard® Premium2 on #5*								
Annealed	45	11	16	91	20	43	37	22	0.5
Heat Treatable	46	12	17	91	20	44	36	22	0.5

The performance values shown are nominal and subject to variations due to manufacturing tolerances. Spectro-photometric values according to EN 410, U-values according to EN 673
* all products in the glazing use Guardian UltraClear™ base glass

Phone: +352 26 1111 e-mail: information@guardian.com

GUARDIAN® GLASS

See what's possible™

www.guardianglass.com

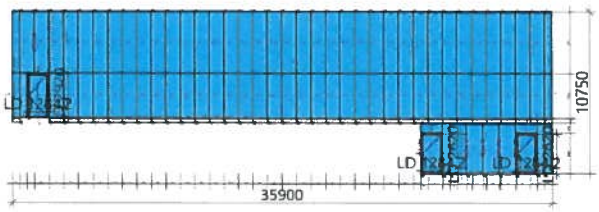
Guardian Europe
Reference code: SUNGUARD_SNX50_FS_EN_0817

4.7.2. Steklene fasade in vrata

Izračun dobavitelja za elemente, skladno s standardom

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Severna fasada	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Façade	35.880,0 mm x 10.900,0 mm	Schüco FWS 50
2	Fixed glazing	484,7 mm x 3.350,0 mm	Schüco FWS 50
4	Fixed glazing	1.090,6 mm x 3.350,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 3.350,0 mm	Schüco FWS 50
2	Fixed glazing	1.454,2 mm x 650,0 mm	Schüco FWS 50
2	Fixed glazing	500,0 mm x 300,0 mm	Schüco FWS 50
34	Fixed glazing	969,4 mm x 300,0 mm	Schüco FWS 50
2	Fixed glazing	500,0 mm x 3.000,0 mm	Schüco FWS 50
1	Fixed glazing	484,7 mm x 3.000,0 mm	Schüco FWS 50
34	Fixed glazing	969,4 mm x 3.000,0 mm	Schüco FWS 50
2	Fixed glazing	500,0 mm x 4.100,0 mm	Schüco FWS 50
1	Fixed glazing	969,5 mm x 4.100,0 mm	Schüco FWS 50
35	Fixed glazing	969,4 mm x 4.100,0 mm	Schüco FWS 50
2	Insert unit	1.428,2 mm x 2.712,0 mm	Schüco AWS 75.SI+/ADS 75.SI
2	Single leaf door DIN RH	1.428,2 mm x 2.712,0 mm	Schüco AWS 75.SI+/ADS 75.SI
1	Insert unit	1.428,2 mm x 3.012,0 mm	Schüco AWS 75.SI+/ADS 75.SI
1	Single leaf door DIN RH	1.428,2 mm x 3.012,0 mm	Schüco AWS 75.SI+/ADS 75.SI

Profiles/combinations	Um/Ut/Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
112720 / 322420	0,79	3,674	52 mm
112720 / 323900	0,79	1,705	52 mm
322280	0,79	0,150	52 mm
322280 / 493770	0,79	13,584	52 mm

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

322420 / 493770	0,79	1,703	52 mm
323470 / 493770	0,79	1,520	52 mm
1.1 381160 / 395720	2,2# +	0,134	PA
7.1 381160 / 395720	2,2# +	0,134	PA
50.1 381160 / 395720	2,2# +	0,134	PA
1.2 395720 / 431980	2,4# +	0,886	PA
7.2 395720 / 431980	2,4# +	0,886	PA
50.2 395720 / 431980	2,4# +	0,969	PA
Total profiles/combinations	**0,99**	**25,479**	

Edge seal insert unit	**Psi W/(mK)**	**Length m**
Field 1	0,070	6,75
Field 50	0,070	7,35
Field 7	0,070	6,75
Edge seal, whole insert unit	**0,070**	**20,862**

Glazing	**Ug W/(m²K)**	**Glass area m²**	**Spacer**
Troslojno 52mm (8-16-4-16-8)	0,5	262,284	Polyisobutylene
Total glazing	**0,5**	**262,284**	

Glass edge seal	**Psi W/(mK)**	**Length m**
Troslojno 52mm (8-16-4-16-8)	0,069	724,472
Troslojno 52mm (8-16-4-16-8)	0,038	22,177
Total glass edge seal	**0,068**	**746,649**

Panel	**Up (W/m²K)**	**Panel area (m²)**
52mm (Alu/Fragmat/Alu)	0,20	8,040
Total panels	**0,20**	**8,040**

Panel edge seal	**Psi W/(mK)**	**Length m**
52mm (Alu/Fragmat/Alu)	0,018 *	82,322
Total panel edge seal	**0,018**	**82,322**

Total surface area (m²)	**295,804**
Frame proportion	**8,61 %**

Heat transfer coefficient Ucw **0,72W/(m²K)**

Calculation of the nominal value of the thermal transmittance Ucw for curtain walling in accordance with EN 12631:2017.

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Um- / Ut- / Ψm,f- / Ψt,f value has been verified by the test report in accordance with the specifications of the product standard EN 13830:2003 and the Uf value has been verified by the test report in accordance with the specifications of the product standard EN 14351-1:2006+A2:2016.

The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

U value listing - Short format

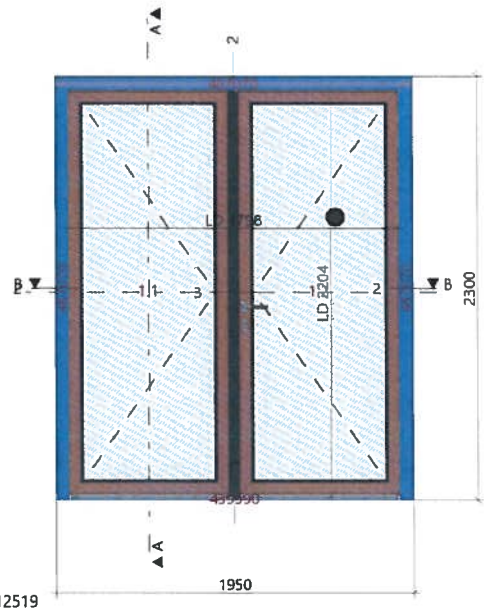
(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Vrata - južna fasada	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Aluminium unit	1.950,0 mm x 2.300,0 mm	Schüco ADS 90 SimplySmart
1	Double leaf door DIN LH	1.950,0 mm x 2.300,0 mm	Schüco ADS 90 SimplySmart

Profiles/combinations	Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
1 439590 / 487170	1,8	0,198	PA
2 487070 / 487170	1,3	0,939	PA
3 487170 / 487170 / 487230	1,3	0,430	PA
Total profiles/combinations	**1,4**	**1,567**	

Panel	Up (W/m²K)	Panel area (m²)
90mm (3Alu-85fragmat-2Alu)	0,37	2,919
Total panels	**0,37**	**2,919**

Panel edge seal	Psi W/(mK)	Length m
90mm (3Alu-85fragmat-2Alu)	0,018 *	11,014
Total panel edge seal	**0,018**	**11,014**

Total surface area (m²)	**4,485**
Frame proportion	**34,92 %**

Nominal value Uw **0,76 W/(m²K)**

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Uf value has been verified by the test report in accordance with the specifications of product standard EN 14351-1:2006+A2:2016.

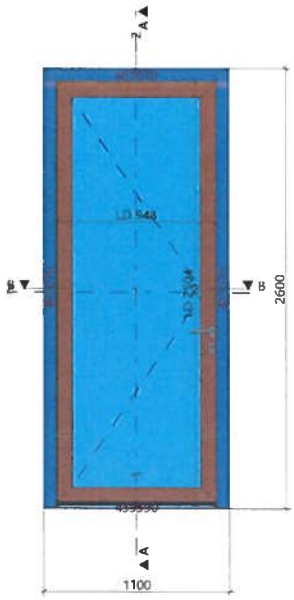
The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
Ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Vrata - severna fasada na not	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Aluminium unit	1.100,0 mm x 2.600,0 mm	Schüco ADS 90 SimplySmart
1	Single leaf door DIN RH	1.100,0 mm x 2.600,0 mm	Schüco ADS 90 SimplySmart

Profiles/combinations	Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
1 439590 / 487140	1,7	0,118	PA
2 487070 / 487140	1,3	0,992	PA
Total profiles/combinations	**1,3**	**1,110**	

Glazing	Ug W/(m²K)	Glass area m²	Spacer
New glass(3)	0,5	1,750	Polyisobutylene
Total glazing	**0,5**	**1,750**	

Glass edge seal	Psi W/(mK)	Length m
New glass(3)	0,038	6,142
Total glass edge seal	**0,038**	**6,142**

Total surface area (m²)	**2,860**
Frame proportion	**38,80 %**

Nominal value Uw **0,91 W/(m²K)**

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Uf value has been verified by the test report in accordance with the specifications of product standard EN 14351-1:2006+A2:2016.

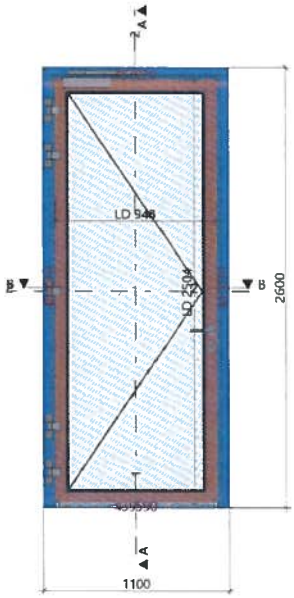
The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
Ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Vrata - severna fasada na ven	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Aluminium unit	1.100,0 mm x 2.600,0 mm	Schüco ADS 90 SimplySmart
1	Single leaf door DIN LH	1.100,0 mm x 2.600,0 mm	Schüco ADS 90 SimplySmart

Profiles/combinations	Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
1 439590 / 487220	1,8	0,104	PA
2 487070 / 487220	1,4	0,900	PA
Total profiles/combinations	**1,4**	**1,004**	

Panel	Up (W/m²K)	Panel area (m²)
90mm (3Alu-85fragmat-2Alu)	0,37	1,856
Total panels	**0,37**	**1,856**

Panel edge seal	Psi W/(mK)	Length m
90mm (3Alu-85fragmat-2Alu)	0,018 *	6,262
Total panel edge seal	**0,018**	**6,262**

Total surface area (m²)	**2,860**
Frame proportion	**35,12 %**

Nominal value Uw **0,79 W/(m²K)**

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Uf value has been verified by the test report in accordance with the specifications of product standard EN 14351-1:2006+A2:2016.

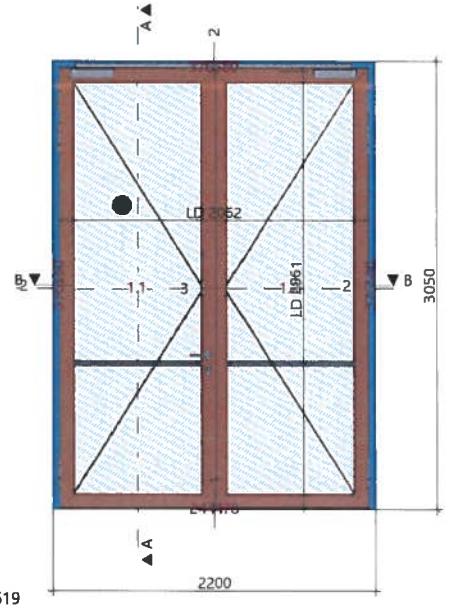
The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631: 2017-07
13-000693- PR02 (PB-K99-06-de-01)
ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Vrata - zahodna fasada	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Aluminium unit	2.200,0 mm x 3.050,0 mm	Schüco AWS 75.SI+/ADS 75.SI
1	Double leaf door DIN LH	2.200,0 mm x 3.050,0 mm	Schüco AWS 75.SI+/ADS 75.SI

Profiles/combinations	Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
1 244478 / 395750	2,1	0,218	PA
2 376580 / 395750	2,0	1,161	PA
3 395690 / 395750	2,1	0,492	PA
Total profiles/combinations	**2,0**	**1,871**	

Panel	Up (W/m²K)	Panel area (m²)
Dämmpaneel	0,70	4,839
Total panels	**0,70**	**4,839**

Panel edge seal	Psi W/(mK)	Length m
Dämmpaneel	0,00 *	14,696
Total panel edge seal	**0,00**	**14,696**

Total surface area (m²)	**6,710**
Frame proportion	**27,89 %**

Nominal value Uw **1,1 W/(m²K)**

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

Using a Psi value of 0.00 (W/mK) for panels is permitted in specific cases in EN ISO 10077-1:2017, section 6.3.2.5.

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Uf value has been verified by the test report in accordance with the specifications of product standard EN 14351-1:2006+A2:2016.

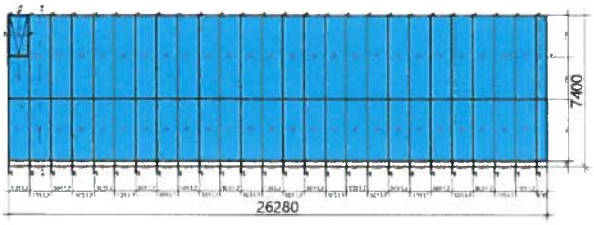
The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
Ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Vzhodna fasada	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Façade	26.295,0 mm x 7.750,0 mm	Schüco FWS 50
25	Fixed glazing	1.031,2 mm x 300,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 300,0 mm	Schüco FWS 50
25	Fixed glazing	1.031,2 mm x 3.000,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 3.000,0 mm	Schüco FWS 50
1	Fixed glazing	1.031,2 mm x 2.050,0 mm	Schüco FWS 50
24	Fixed glazing	1.031,2 mm x 4.100,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 4.100,0 mm	Schüco FWS 50
1	Insert unit	977,2 mm x 1.996,0 mm	Schüco AWS 114.SI
1	Projected top hung window	977,2 mm x 1.996,0 mm	Schüco AWS 114.SI

Profiles/combinations	Um/Ut/Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
112720 / 322420	0,79	2,550	52 mm
112720 / 323900	0,79	1,250	52 mm
322280 / 493770	0,79	9,685	52 mm
322420 / 493770	0,79	1,250	52 mm
79.1 448150 / 449000	1,8#	0,354	PA
Total profiles/combinations	**0,81**	**15,089**	

Edge seal insert unit	Psi W/(mK)	Length m
Field 79	0,050	5,96
Edge seal, whole insert unit	**0,050**	**5,962**

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

Glazing	**Ug W/(m²K)**	**Glass area m²**	**Spacer**
Troslojno 52mm (8-16-4-16-8)	0,5	174,457	Polyisobutylene
Total glazing	**0,5**	**174,457**	

Glass edge seal	**Psi W/(mK)**	**Length m**
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,88 / 0,98
Troslojno 52mm (8-16-4-16-8)	0,069 / 0,067	6,35 / 0,45
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 4,98
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08

U value listing - Short format

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Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,98 / 9,08
Troslojno 52mm (8-16-4-16-8)	0,067 / 0,069	0,45 / 8,55
Troslojno 52mm (8-16-4-16-8)	0,038	5,466
Total glass edge seal	**0,068**	**465,266**

Panel	**Up (W/m²K)**	**Panel area (m²)**
52mm (Alu/Fragmat/Alu)	0,20	6,245
Total panels	**0,20**	**6,245**

Panel edge seal	**Psi W/(mK)**	**Length m**
52mm (Alu/Fragmat/Alu)	0,018 *	62,960
Total panel edge seal	**0,018**	**62,960**

Total surface area (m²)	**195,792**
Frame proportion	**7,71 %**

Heat transfer coefficient Ucw **0,68W/(m²K)**

Calculation of the nominal value of the thermal transmittance Ucw for curtain walling in accordance with EN 12631:2017.

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

Using a Psi value of 0.00 (W/mK) for panels is permitted in specific cases in EN ISO 10077-1:2017, section 6.3.2.5.

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Um- / Ut- / Ψm,f- / Ψt,f value has been verified by the test report in accordance with the specifications of the product standard EN 13830:2003 and the Uf value has been verified by the test report in accordance with the specifications of the product standard EN 14351-1:2006+A2:2016.

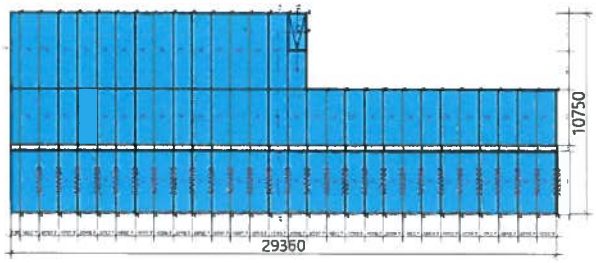
The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631: 2017-07
13-000693- PR02 (PB-K99-06-de-01)
ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++



Outside
DIN EN 12519

Project number:	9437.50.1(18) - Bazen Nova Gorica	Project name:	
Item number:	Zahodna fasada	Item description:	
Creation date:	16. 07. 2019 (Administrator)	Last change:	16. 07. 2019 (Administrator)

Number	Description	Dim.	System
1	Façade	29.375,0 mm x 10.900,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 3.350,0 mm	Schüco FWS 50
28	Fixed glazing	1.030,7 mm x 3.350,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 300,0 mm	Schüco FWS 50
28	Fixed glazing	1.030,7 mm x 300,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 3.000,0 mm	Schüco FWS 50
28	Fixed glazing	1.030,7 mm x 3.000,0 mm	Schüco FWS 50
1	Fixed glazing	500,0 mm x 4.100,0 mm	Schüco FWS 50
14	Fixed glazing	1.030,7 mm x 4.100,0 mm	Schüco FWS 50
1	Fixed glazing	1.030,7 mm x 2.050,0 mm	Schüco FWS 50
1	Insert unit	976,7 mm x 1.996,0 mm	Schüco AWS 114.SI
1	Projected top hung window	976,7 mm x 1.996,0 mm	Schüco AWS 114.SI

Profiles/combinations	Um/Ut/Uf W/(m²K)	Frame area m² Face width * Length	Distance between insulating bars
112720 / 322420	0,79	2,843	52 mm
112720 / 323900	0,79	1,397	52 mm
322280 / 493770	0,79	12,995	52 mm
322420 / 493770	0,79	2,156	52 mm
104.1 448150 / 449000	1,8#	0,354	PA
Total profiles/combinations	**0,81**	**19,745**	

Edge seal insert unit	Psi W/(mK)	Length m
Field 104	0,050	5,96

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

Edge seal, whole insert unit	**0,050**	**5,961**	
Glazing	**Ug W/(m²K)**	**Glass area m²**	**Spacer**
Troslojno 52mm (8-16-4-16-8)	0,5	235,435	Polyisobutylene
Total glazing	**0,5**	**235,435**	
Glass edge seal	**Psi W/(mK)**	**Length m**	
Troslojno 52mm (8-16-4-16-8)	0,069	629,961	
Troslojno 52mm (8-16-4-16-8)	0,038	5,465	
Total glass edge seal	**0,069**	**635,426**	
Panel	**Up (W/m²K)**	**Panel area (m²)**	
52mm (Alu/Fragmat/Alu)	0,20	6,977	
Total panels	**0,20**	**6,977**	
Panel edge seal	**Psi W/(mK)**	**Length m**	
52mm (Alu/Fragmat/Alu)	0,018 *	70,320	
Total panel edge seal	**0,018**	**70,320**	
Total surface area (m²)		**262,157**	
Frame proportion		**7,53 %**	

Heat transfer coefficient Ucw **0,69W/(m²K)**

Calculation of the nominal value of the thermal transmittance Ucw for curtain walling in accordance with EN 12631:2017.

Calculation of the nominal value of the thermal transmittance Uw for windows / UD for doors in accordance with EN ISO 10077-1:2017. The measurement value Uw,BW / UD,BW of the thermal transmittance is the same as the nominal value.

Using a Psi value of 0.00 (W/mK) for panels is permitted in specific cases in EN ISO 10077-1:2017, section 6.3.2.5.

+ = The Uf value for profiles with polythermide bars is calculated for the generation of the U value for window systems. The use of polyamide bars produces different values, which compensate for the Uf value up to a final calculation, depending on the system

= unlike the setting in the fabrication data block, polyamide insulating bars are calculated.

* = Manually adjusted value. The Um- / Ut- / Ψm,f- / Ψt,f value has been verified by the test report in accordance with the specifications of the product standard EN 13830:2003 and the Uf value has been verified by the test report in accordance with the specifications of the product standard EN 14351-1:2006+A2:2016.

The input data of the existing calculation has not been tested by ift Rosenheim and should be used as accompanying documents to a relevant verification.The user is responsible for the accuracy of the data entered and the results calculated from it,

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Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
ift WA-05/2 2012-08

U value listing - Short format

(9437.50.1(18) - Bazen Nova Gorica)/Severna fasada/+++

Project: 9437.50.1(18) - Bazen Nova Gorica

Item	Number	Unit surface area (m²)	Total unit surface area (m²)	U-value (W/m²K)	Proportion of the surface
Severna fasada	1	295,804	295,804	0,72	38,38 %
Vrata - južna fasada	1	4,485	4,485	0,76	0,58 %
Vrata - severna fasada na not	1	2,860	2,860	0,91	0,37 %
Vrata - severna fasada na ven	1	2,860	2,860	0,79	0,37 %
Vrata - zahodna fasada	1	6,710	6,710	1,1	0,87 %
Vzhodna fasada	1	195,792	195,792	0,68	25,41 %
Zahodna fasada	1	262,157	262,157	0,69	34,02 %
Total	**7**		**770,668**	**0,70**	**100,00 %**

Frame area (m²)	65,865	8,55 %
Glass area (m²)	673,927	87,45 %
Panel area (m²)	30,876	4,01 %

The U value calculation in SchüCal with the calculation module from 20.06.2013 has been tested by ift Rosenheim for plausibility in accordance with ift guideline WA-05/2.

Berechnungskern calculation engine
EN ISO 10077-1: 2017-07
EN ISO 12631:2017-07
13-000693- PR02 (PB-K99-06-de-01)
ift WA-05/2 2012-08

The details on this output list calculated by the programme have to be checked for correctness!

Please observe the accompanying messages or error lists.