Technical Note			TN-008
Test: DH Low temperature tests			**Test no.:** 1d, 1e, 1f, 2b, 3b, 4b, 5b
Assumption: 55 °C flow temperature			**Assumption no:008**
Rev: 01	**Date:** 13/12/2019	**Author:** Josu Aurrekoetxea	**Checked:** Gareth Jones

1. Introduction

The next technical note analyses if it is viable to perform all Low Temperature tests with 55 °C of DH flow temperature.

2. 55 °C temperature on heating test

The most demanding heating test is 1f requiring 4 kW with 35-45 °C conditions. These conditions will be easy to achieve for most HIUs with the current heating PHEs. This test won't suppose any problem to perform.

3. DHW dynamic test

DHW supply tests are the most demanding ones because the power requirements are higher while keeping smaller temperature approach at the flow side.

2 models of main HIU PHE manufactures have been checked using the software supplied by these manufacturers. The selection of PHE model has been based on the PHE being able to achieve 42 kW in the same conditions. Appendix 1 and 3 show the results of the PHE with 0.13 kg/s of DHW demand at 50 °C. Both PHE perform properly.

4. Maximum power performance

Current Besa test was thought to test the HIU at the most common demand conditions. However, the lower flow temperature limits the capacity of the HIU delivering higher demands than tested. Appendix 2 and 4 show the capacity of the PHEs to achieve 42 kW.

Notice that Swep PHE had to be installed switching the circuits in other to have a reasonable pressure drop at the primary side. On the test, pressure drop should be also measured on the secondary side.

5. Conclusions

The test at 55 °C is doable, however, the HIU manufacturers will need to select very carefully the PHE of their HIUs. Not all the HIUs in the market will be capable of delivering the proper demand with 55 °C on the primary temperature.

Any consultant that decides to run their system at 55 °C will also need to keep in mind the DHW demand reduction.

6. Recommendation

It is recommended to test the HIUs at 55 °C DH temperature. However, it is highly recommended to add another test that shows the maximum power achievable by the HIU with these conditions.

7. References

[1] Appendix 1: Calculation of Performance of Swep E8LAS-40 with 55 °C flow 0.13 kg/s DHW at 50 °C

[2] Appendix 2: Calculation of performance of Swep E8LAS-40 with 55 °C 42kW DHW at 50 °C

[3] Appendix 3: Calculation of performance of Danfoss XB06-36 with 55 °C flow 0.13kg/s DHW at 50 °C

[4] Appendix 4: Calculation of performance of Danfoss XB06-36 with 55 °C 42kW DHW at 50 °C

SWEP International AB
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SINGLE PHASE - PERFORMANCE
HEAT EXCHANGER: E8LASHx40/1P

SSP G8 - 2019.1025.2.0

Date: 13/12/2019

SSP Alias: E8LASN-W

DUTY REQUIREMENTS		Side 1		Side 2
Fluid		**Water**		**Water**
Flow type			**Counter-Current**	
Circuit		Inner		Outer
Chanel		narrow		wide
Heat load	kW		21.73	
Inlet temperature	°C	**55.00**		**10.00**
Outlet temperature	°C	19.17		**50.00**
Flow rate	kg/s	0.1451		**0.1300**
Thermal length		5.212		5.818

PLATE HEAT EXCHANGER		Side 1		Side 2
Total heat transfer area	m²		0.961	
Heat flux	kW/m²		22.6	
Mean temperature difference	K		6.87	
O.H.T.C. (available/required)	W/m²,°C		3290/3290	
Pressure drop - total*	kPa	10.5		3.99
- in ports	kPa	0.248		0.199
Port diameter (up/down)	mm	16.0/16.0		16.0/16.0
Number of channels per pass		19		20
Number of plates			40	
Oversurfacing	%		0	
Fouling factor	m²,°C/kW		0.000	
Reynolds number		302.9		223.1
Port velocity (up/down)	m/s	0.727/0.727		0.649/0.649
Channel velocity	m/s	0.0958		0.0813
Shear stress	Pa	20.2		7.50
Average wall temperature	°C	34.53		34.24
Largest wall temperature difference	K		0.58	
Minimal/Maximal wall temperature	°C	15.94/53.24		15.36/52.92

**Excluding pressure drop in connections.*

NOTES

i *This is an asymmetric model. Side 1 refers to circuit F1-F3. Side 2 refers to circuit F2-F4.*

PHYSICAL PROPERTIES		Side 1	Side 2
Reference temperature	°C	37.08	30.00
Dynamic viscosity	cP	0.691	0.798
Dynamic viscosity - wall	cP	0.727	0.731
Density	kg/m³	993.3	995.7
Heat capacity	kJ/kg,°C	4.178	4.179
Thermal conductivity	W/m,°C	0.6264	0.6154
Film coefficient	W/m²,°C	9330	5630

TOTALS		Side 1	Side 2
Total weight empty (no connections)*	kg	2.67 - 2.79	
Total weight filled (no connections)*	kg	3.53 - 3.65	
Hold-up volume (Inner Circuit)	dm³	0.39	
Hold-up volume (Outer Circuit)	dm³	0.48	
Port size F1/P1	mm	16	
Port size F2/P2	mm	16	

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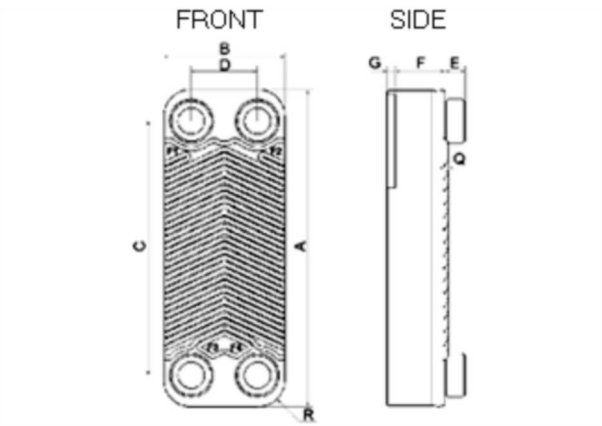
TOTALS		Side 1	Side 2
Port size F3/P3	mm		16
Port size F4/P4	mm		16
Carbon footprint	kg		18.73

**Weight depends on the selected product.*

DIMENSIONS



A	mm	316 ±2
B	mm	74 ±1
C	mm	278 ±1
D	mm	40 ±1
E	mm	12 - 20 / 20 ±1
F	mm	52.16 - 54.8 ±2.5%
G	mm	6 - 7 ±1
Q	mm	1.1
R	mm	17

**This is a schematic sketch. For correct drawings please use the order drawing function or contact your SWEP representative.*

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SINGLE PHASE - PERFORMANCE
HEAT EXCHANGER: E8LASHx40/1P

SSP G8 - 2019.1025.2.0

Date: 13/12/2019

SSP Alias: E8LASW-N

DUTY REQUIREMENTS		Side 1		Side 2
Fluid		**Water**		**Water**
Flow type			**Counter-Current**	
Circuit		Outer		Inner
Chanel		wide		narrow
Heat load	kW		**42.00**	
Inlet temperature	°C	**55.00**		**10.00**
Outlet temperature	°C	23.20		**50.00**
Flow rate	kg/s	0.3161		0.2513
Thermal length		3.765		4.736

PLATE HEAT EXCHANGER		Side 1		Side 2
Total heat transfer area	m²		0.961	
Heat flux	kW/m²		43.7	
Mean temperature difference	K		8.45	
O.H.T.C. (available/required)	W/m²,°C		5180/5180	
Pressure drop - total*	kPa	18.8		29.8
- in ports	kPa	1.18		0.743
Port diameter (up/down)	mm	16.0/16.0		16.0/16.0
Number of channels per pass		20		19
Number of plates			40	
Oversurfacing	%		0	
Fouling factor	m²,°C/kW		0.000	
Reynolds number		651.4		454.0
Port velocity (up/down)	m/s	1.58/1.58		1.26/1.26
Channel velocity	m/s	0.198		0.165
Shear stress	Pa	34.9		57.5
Average wall temperature	°C	34.25		33.66
Largest wall temperature difference	K		1.14	
Minimal/Maximal wall temperature	°C	16.32/52.40		15.19/51.97

**Excluding pressure drop in connections.*

NOTES

i *This is an asymmetric model. Side 1 refers to circuit F2-F4. Side 2 refers to circuit F1-F3.*

PHYSICAL PROPERTIES		Side 1	Side 2
Reference temperature	°C	39.10	30.00
Dynamic viscosity	cP	0.665	0.798
Dynamic viscosity - wall	cP	0.731	0.740
Density	kg/m³	992.6	995.7
Heat capacity	kJ/kg,°C	4.179	4.179
Thermal conductivity	W/m,°C	0.6293	0.6154
Film coefficient	W/m²,°C	9940	13200

TOTALS		Side 1	Side 2
Total weight empty (no connections)*	kg	2.67 - 2.79	
Total weight filled (no connections)*	kg	3.53 - 3.65	
Hold-up volume (Inner Circuit)	dm³	0.39	
Hold-up volume (Outer Circuit)	dm³	0.48	
Port size F1/P1	mm	16	
Port size F2/P2	mm	16	

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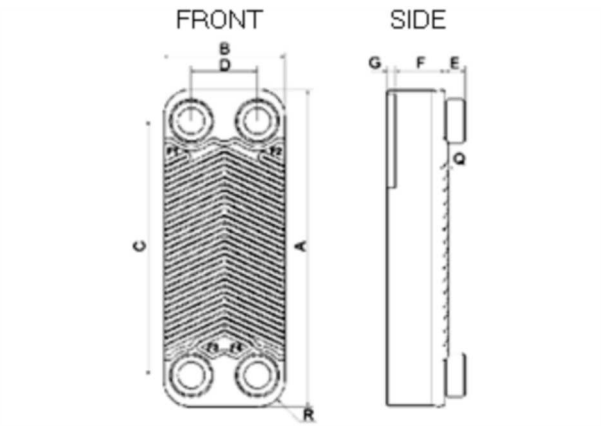
TOTALS		Side 1	Side 2
Port size F3/P3	mm		16
Port size F4/P4	mm		16
Carbon footprint	kg		18.73

**Weight depends on the selected product.*

DIMENSIONS



A	mm	316 ±2
B	mm	74 ±1
C	mm	278 ±1
D	mm	40 ±1
E	mm	12 - 20 / 20 ±1
F	mm	52.16 - 54.8 ±2.5%
G	mm	6 - 7 ±1
Q	mm	1.1
R	mm	17

**This is a schematic sketch. For correct drawings please use the order drawing function or contact your SWEP representative.*

Plate Heat Exchanger Datasheet

Danfoss Hexact(v5.2.23) **Ref.:** JA20191213091452

Customer:				*Contact person:*	
Project:				*E-mail:*	
HEX Type:	XB06H-1-36 CU			*Engineer:*	JA
Unit:	1 (Parallel)	Code:	004B2043	*Date:*	13/12/2019 09:14:59

Calculated parameters	**Unit**	**Side1**	**Side2**
Flow Type		Counter current	
Load	kW	21.80	
Inlet temperature	°C	55.00	10.00
Outlet temperature (Specified)	°C	--	50.00
Outlet temperature (Actual)	°C	23.89	--
Mass Flowrate	kg/h	603.6	469.0
Volumetric Flowrate	L/min	10.130	7.845
Total pressure drop	kPa	3.05	1.83
Pressure drop - In port	kPa	0.25	0.15
Total area	m^2	0.92	
Surface margin	%	0.0	
LMTD	K	8.70	
HTC(Available / Service / Required)	W/m^2-K	2729.5/2729.5/2729.0	
Port velocity	m/s	0.66	0.51

Properties of fluid	**Unit**	**Side1**	**Side2**
Fluid		Water(1.600System.Windows.Forms.Label, Text: bar)	Water(1.600System.Windows.Forms.Label, Text: bar)
Dynamic viscosity	mPa-s	0.6631	0.8019
Density	kg/m^3	993.2	996.3
Heat capacity	kJ/kg-K	4.175	4.177
Thermal conductivity	W/m-K	0.626	0.613

Specification:	**Unit**	**Side1**	**Side2**
HEX Type:			XB06H-1-36 CU
Number of plates:	---		36
Max.number of plates in current frame:	---		--
Grouping:	---		1*17H/1*18H
Plate Material:	---		EN1.4404(AISI316L)
Gasket / Brazing Material:	---		CU
Connection size:	---		G 3/4
Connection type:	---		Thread
Frame color:	---		--
Certification/Approval type:	---		PED Art 4.3
Volume:	L	0.289	0.306
Weight:	kg		3.55
Design Temp. (Max/Min):	°C		55/10
Design Pressure(Max):	bar		25

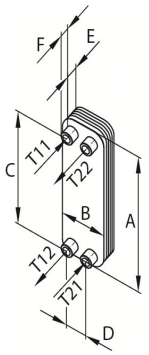
Items:

Code	Pcs	Components
004B2043	1	XB06H-1-36 CU

External Dimensions:

A (mm):	320	B (mm):	95
C (mm):	270	D (mm):	45
E (mm):	52	F (mm):	20

Warning: Dimensions are for reference purposes only and are not to be used for construction.



Comments:

Copper brazed stainless steel heat exchanger designed and configured for district heating systems, district cooling and other heating applications. The brazed heat exchanger features our new MICRO PLATES™, which enable heat to be transferred more effectively than in any previous model.Energy and cost savings, Longer life time, Corrosion-resistant design, Compact Design.

Plate Heat Exchanger Datasheet

Danfoss Hexact(v5.2.23) **Ref.:** JA20191213091352

Customer:				*Contact person:*	
Project:				*E-mail:*	
HEX Type:	XB06H-1-36 CU			*Engineer:*	JA
Unit:	1 (Parallel)	Code:	004B2043	*Date:*	13/12/2019 09:14:00

Calculated parameters	**Unit**	**Side1**	**Side2**
Flow Type		Counter current	
Load	kW	42.00	
Inlet temperature	°C	55.00	10.00
Outlet temperature (Specified)	°C	--	50.00
Outlet temperature (Actual)	°C	27.69	--
Mass Flowrate	kg/h	1324.9	903.5
Volumetric Flowrate	L/min	22.250	15.114
Total pressure drop	kPa	12.46	5.95
Pressure drop - In port	kPa	1.22	0.56
Total area	m^2	0.92	
Surface margin	%	0.0	
LMTD	K	10.04	
HTC(Available / Service / Required)	W/m^2-K	4554.9/4554.9/4555.0	
Port velocity	m/s	1.46	0.99

Properties of fluid	**Unit**	**Side1**	**Side2**
Fluid		Water(1.600System.Windows.Forms.Label, Text: bar)	Water(1.600System.Windows.Forms.Label, Text: bar)
Dynamic viscosity	mPa-s	0.6398	0.8019
Density	kg/m^3	992.4	996.3
Heat capacity	kJ/kg-K	4.175	4.177
Thermal conductivity	W/m-K	0.629	0.613

Specification:	**Unit**	**Side1**	**Side2**
HEX Type:			XB06H-1-36 CU
Number of plates:	---		36
Max.number of plates in current frame:	---		--
Grouping:	---		1*17H/1*18H
Plate Material:	---		EN1.4404(AISI316L)
Gasket / Brazing Material:	---		CU
Connection size:	---		G 3/4
Connection type:	---		Thread
Frame color:	---		--
Certification/Approval type:	---		PED Art 4.3
Volume:	L	0.289	0.306
Weight:	kg		3.55
Design Temp. (Max/Min):	°C		55/10
Design Pressure(Max):	bar		25

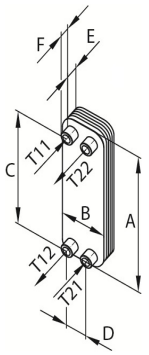
Items:

Code	Pcs	Components
004B2043	1	XB06H-1-36 CU

External Dimensions:

A (mm):	320	B (mm):	95
C (mm):	270	D (mm):	45
E (mm):	52	F (mm):	20

Warning: Dimensions are for reference purposes only and are not to be used for construction.



Comments:

Copper brazed stainless steel heat exchanger designed and configured for district heating systems, district cooling and other heating applications. The brazed heat exchanger features our new MICRO PLATES™, which enable heat to be transferred more effectively than in any previous model.Energy and cost savings, Longer life time, Corrosion-resistant design, Compact Design.