



**Air-Conditioning, Heating, and Refrigeration  
Institute (AHRI) Low-GWP Alternative Refrigerants  
Evaluation Program (Low-GWP AREP)**

## **TEST REPORT #29**

### **Compressor Calorimeter Test of R- 404A Alternative Refrigerant DR-7 in Reciprocating Compressors**

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**This report has been made available to the public  
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AHRI's Low-GWP AREP.**



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## List of Tested Refrigerant's Compositions (Mass%)

DR-7	R-32/R-1234yf (36/64)
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## 1. Introduction:

Scope of the work is evaluation of the compressor performance with new low GWP refrigerant DR-7 in compressor NEK2134GK primarily used for R404A refrigerant.

## 2. Details of Test Setup:

### a. Description of Test Refrigerant-Lubricant and Charge

- Refrigerant or refrigerant blend tested
  - R404A by supplier LINDE
  - New mixture refrigerant named DR-7 delivered by DuPont
- Lubricant
  - Compressor lubricant is POE oil Emkarate RL 22HB by Lubrizol

### b. Description of Compressors and test conditions/methodology

The evaluation was done by testing of 2 compressors model NEK2134GK, 958AG71 made by Embraco, type hermetic reciprocating one piston compressor. Compressors are primarily used for R404A refrigerant. First test was done with R404A for purpose of reference values and then they were tested with new refrigerant DR-7. Average from 2 compressors was considered in the final results.

Model	NEK2134GK	NEK2134GK
BOM	958AG71	958AG71
Application	LBP-HST	LBP-HST
S/N	P12RLC52	P12RPA8D
Oil	POE 22	POE 22
Motor	CSIR, monophase	CSIR, monophase
Power supply	115V/60Hz	115V/60Hz
Ambient temperature	35°C	35°C
Subcooling	0°C	0°C
Fan cooling	270 m <sup>3</sup> /h	270 m <sup>3</sup> /h
Temperature determination	Dewpoint	Dewpoint

*Table 2-1, Compressor configuration and test description*

Thermodynamic properties of R404A determined from Refprop 6.0 (by NIST USA), thermodynamic properties of DR-7 determined from files received from DuPont.

**c. Test facilities**

The performance tests were performed on a calorimeter using Calorimetric method A Secondary fluid calorimeter on the suction side, see EN13771. Before the measurements were done, the calorimeter was cleaned from potential residues of previous tests, evacuated and subsequently charged with the correct refrigerant R404A and DR-7.

Calorimeter charge with R404A: 0.7 kg

Calorimeter charge with DR-7: 1.2 kg

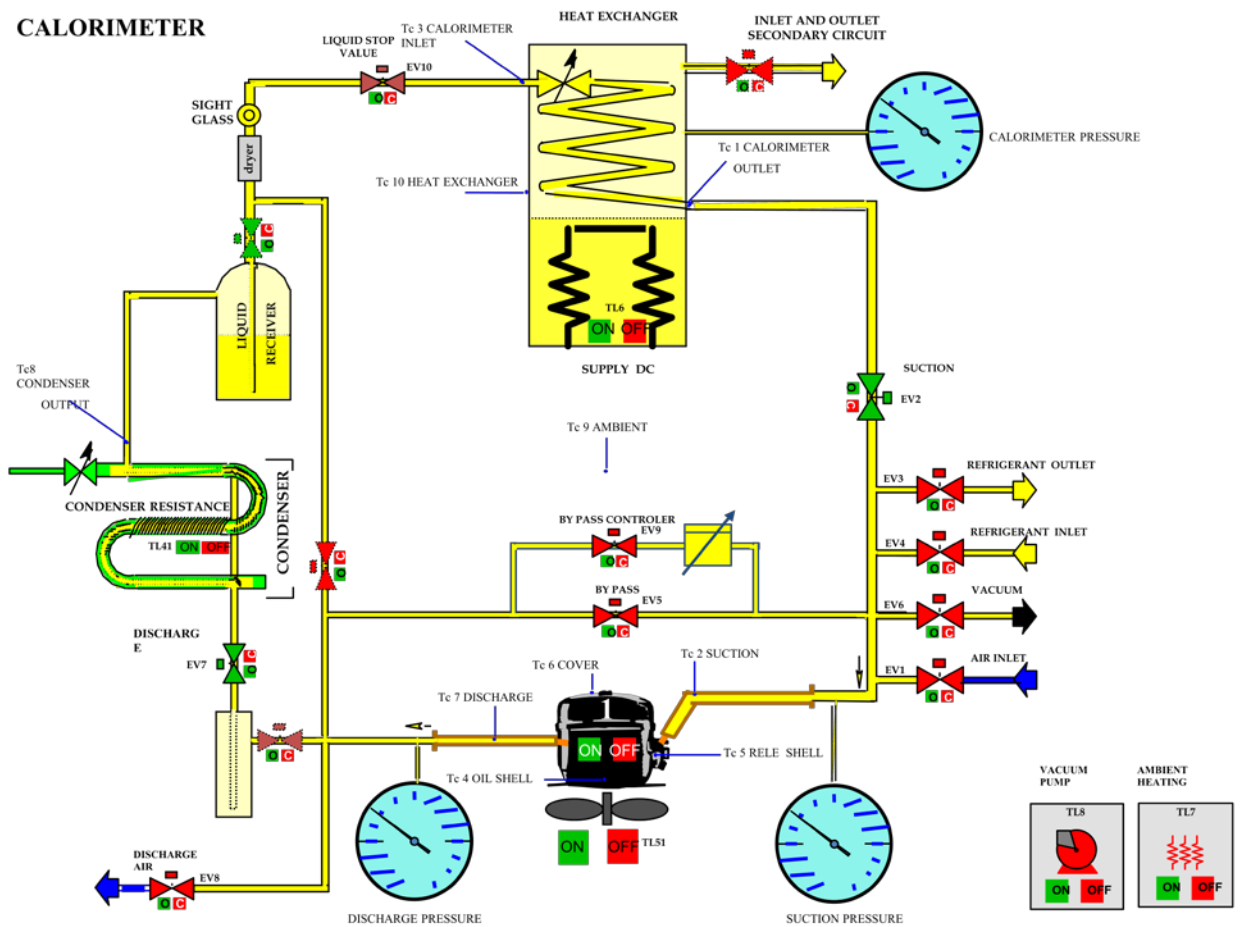


Figure 2-1, Schematic diagram of the calorimeter

Parameter	Instrument	Accuracy
Compressor power input	Yokogawa WT230	± (0.1% of reading + 0.1% of range),
Compressor voltage	Yokogawa WT230	± (0.1% of reading + 0.1% of range), 300 V
Compressor current	Yokogawa WT230	± (0.1% of reading + 0.1% of range), 10 A
Heat exchanger DC power input	Yokogawa WT230	± (0.3% of reading + 0.2% of range)
Heat exchanger DC voltage	Yokogawa WT230	± (0.2% of reading + 0.2% of range), 300 V
Heat exchanger DC current	Yokogawa WT230	± (0.2% of reading + 0.2% of range), 20 A
Suction pressure transducer	BD sensor 10 bar	± 0.1% of range
Discharge pressure transducer	BD sensor 40 bar	± 1% of range
Temperature - Heat exchanger input	TC "T", Agilent 34970A	± 0.5°C
Temperature - Heat exchanger output	TC "T", Agilent 34970A	± 0.5°C
Temperature - Heat exchanger internal	TC "T", Agilent 34970A	± 0.3°C
Temperature - Calorimeter ambient	TC "T", Agilent 34970A	± 0.5°C
Temperature - Compressor shell	TC "T", Agilent 34970A	± 0.5°C
Temperature - Return gas	TC "T", Agilent 34970A	± 0.5°C

Table 2-2, List of instruments with their accuracy

**d. Coefficients equation format**

Coefficients equation format:

$$X = C1 + C2 \cdot (S) + C3 \cdot D + C4 \cdot (S^2) + C5 \cdot (S \cdot D) + C6 \cdot (D^2) + C7 \cdot (S^3) + C8 \cdot (D \cdot S^2) + C9 \cdot (S \cdot D^2) + C10 \cdot (D^3)$$

where:

C = Equation coefficient, represents compressor performance

S = Suction dew point temperature, °F [°C]

D = Discharge dew point temperature, °F [°C]

X = compressor performance (mass flow rate, capacity, power and COP)

**e. Uncertainties**

Uncertainty for cooling capacity: ± 47.29 BTU/h (valid for all points)

Power input uncertainty: ± 3.46 W (valid for all points)

### 3. Results

#### **General statement:**

All compressor tests are performed at a refrigerant's dew point temperature for suction and discharge pressure conditions, per AHRI Standard 540 requirements. This does not have an impact on comparing compressor performance between two or more refrigerants that do not exhibit temperature glide. However, when refrigerants exhibit temperature glide, it is important to note that actual systems operate closer to the mid-point condition. When comparing compressor performance of one refrigerant with glide to another refrigerant without glide, or comparing two refrigerants with significantly different glides, comparison at pressures corresponding to the mid-point of the temperature glide rather than the dew point will yield results that are more representative of actual operation in a system.

### 3.1. Return gas temperature 18.3 °C

#### 3.1.1. Reference measurement with R404A

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	BTU/h	W	A	(BTU/Wh)	kg/h
R404A	30	-12	18.3	30.3	3399.9	458.4	5.80	7.42	25.01
R404A	30	-20	18.3	38.3	2399.7	398.1	5.39	6.03	17.40
R404A	30	-30	18.3	48.3	1477.2	324.4	4.97	4.56	10.59
R404A	30	-40	18.3	58.3	897.4	263.0	4.71	3.41	6.39
R404A	45	-12	18.3	30.3	2635.8	521.8	6.22	5.05	23.39
R404A	45	-20	18.3	38.3	1864.1	443.9	5.68	4.20	16.33
R404A	45	-30	18.3	48.3	1177.3	349.5	5.11	3.37	10.15
R404A	45	-40	18.3	58.3	653.6	261.9	4.67	2.50	5.58
R404A	60	-12	18.3	30.3	1841.5	587.0	6.69	3.14	21.49
R404A	60	-20	18.3	38.3	1301.3	483.6	5.93	2.69	14.88
R404A	60	-30	18.3	48.3	782.9	360.5	5.15	2.17	8.79
R404A	60	-40	18.3	58.3	396.5	247.4	4.62	1.60	4.41

*Table 3-1a., Measured data of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C*

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
R404A	30	-12	18.3	30.3	2.6	0.6	0.9	1.9	2.8
R404A	30	-20	18.3	38.3	2.0	0.6	1.1	1.4	2.1
R404A	30	-30	18.3	48.3	2.2	1.7	1.4	3.8	2.1
R404A	30	-40	18.3	58.3	1.4	2.9	1.3	1.5	1.8
R404A	45	-12	18.3	30.3	1.6	1.7	1.3	0.0	1.4
R404A	45	-20	18.3	38.3	1.2	1.4	1.2	0.2	1.2
R404A	45	-30	18.3	48.3	0.5	3.0	2.0	3.4	0.2
R404A	45	-40	18.3	58.3	2.1	2.7	1.5	0.6	2.0
R404A	60	-12	18.3	30.3	2.2	3.0	2.1	0.7	2.3
R404A	60	-20	18.3	38.3	2.4	2.8	2.0	0.3	2.1
R404A	60	-30	18.3	48.3	4.0	3.6	2.4	0.4	4.1
R404A	60	-40	18.3	58.3	4.2	3.6	2.0	0.6	3.9

*Table 3-1b., Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C*

Coefficients	Capacity (BTU/h, °C)	Mass flow (kg/h, °C)	Power input (W, °C)
C1	8.633E+03	5.039E+01	3.710E+02
C2	2.922E+02	1.919E+00	3.588E+00
C3	-1.360E+02	-4.483E-01	5.509E+00
C4	3.689E+00	2.900E-02	-6.073E-02
C5	-3.030E+00	-9.549E-03	6.228E-02
C6	1.310E+00	6.495E-03	6.398E-03
C7	1.238E-02	1.532E-04	-1.175E-03
C8	-3.356E-02	-1.197E-04	1.103E-04
C9	2.412E-04	1.556E-05	1.282E-03
C10	-1.034E-02	-5.299E-05	5.070E-05

Table 3-2., Coefficients C1 – C10 for NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C

**CURVE-FITTED CHARTS**

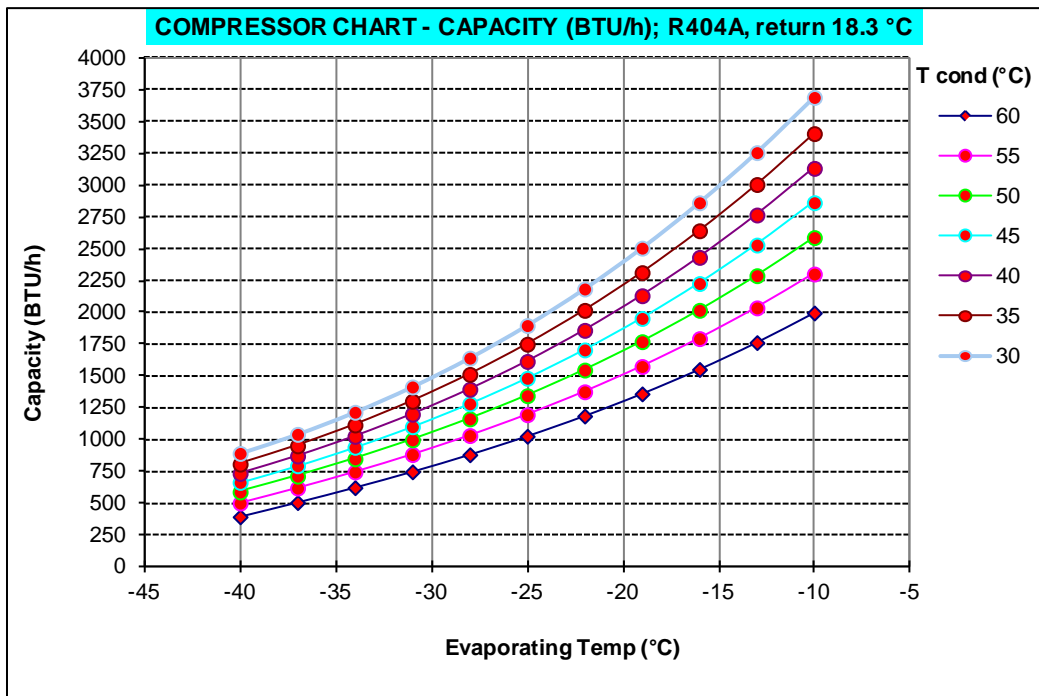


Figure 3-1, Cooling capacity of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C



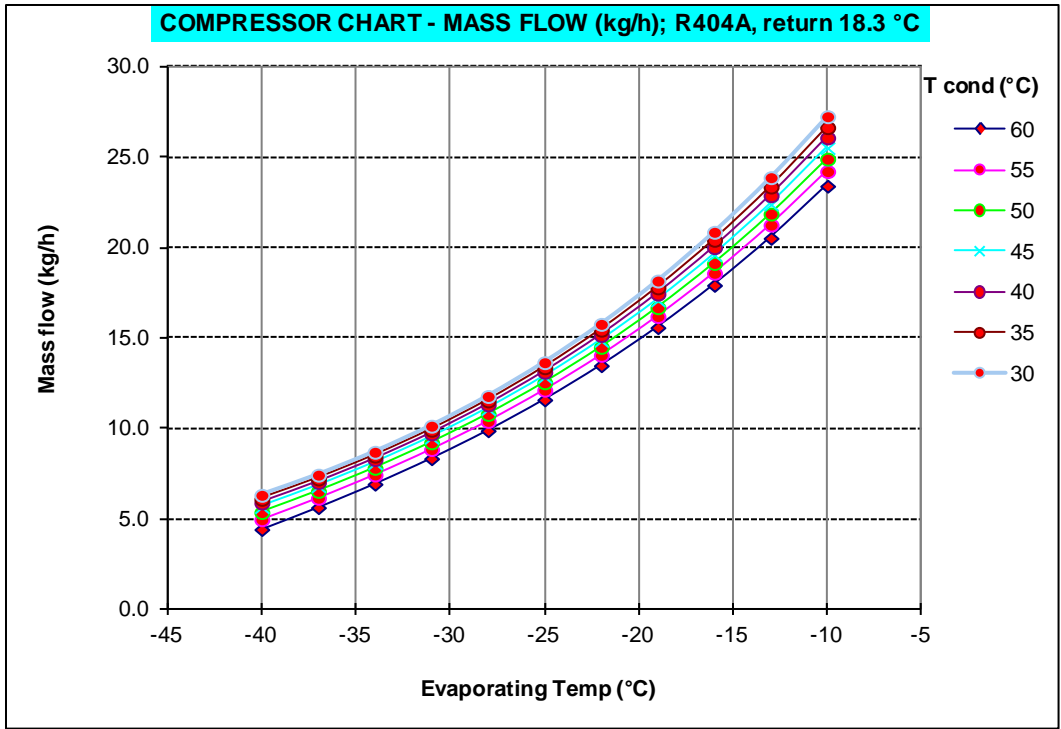


Figure 3-2, Mass flow of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C

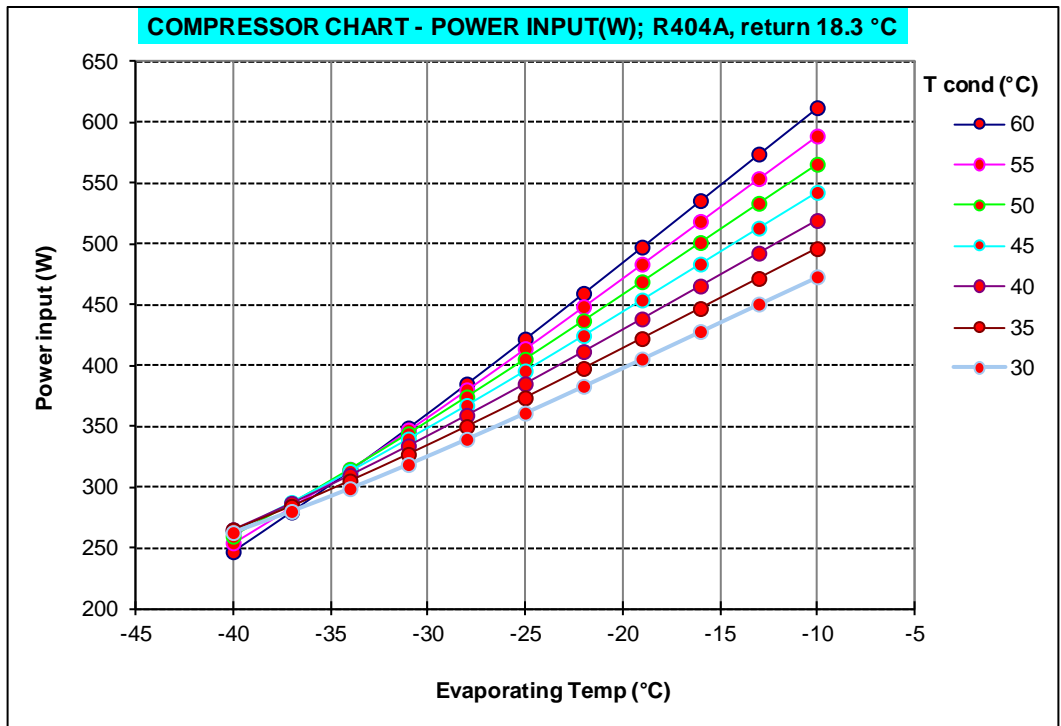


Figure 3-3, Power input of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C

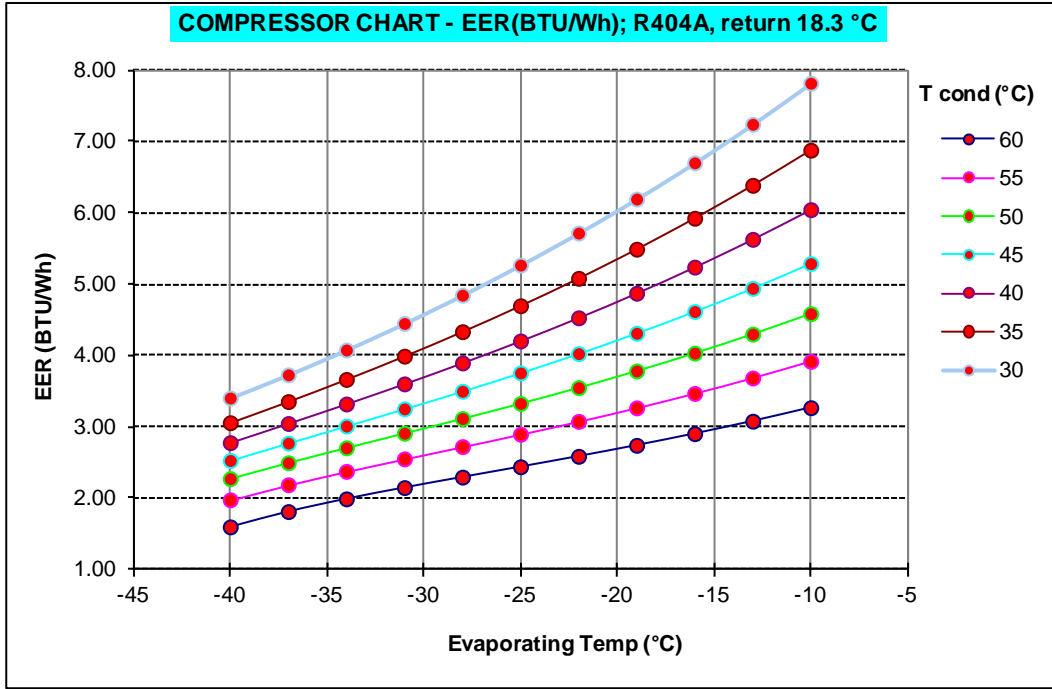


Figure 3-4, EER of NEK2134GK, refrigerant R404A, return gas temperature 18.3 °C

### 3.1.2. Measurement with new refrigerant DR-7

AVERAGE REFRIGERANT	T cond (dew) (°C)	T evap (dew) (°C)	T return gas (°C)	T Superheat (°C)	Cool. Capacity (BTU/h)	Power input (W)	Current (A)	EER (BTU/Wh)	Mass flow (kg/h)
DR7	30	-12	18.3	30.3	3132.2	427.8	5.71	7.32	21.61
DR7	30	-20	18.3	38.3	2179.9	373.9	5.37	5.83	14.88
DR7	30	-30	18.3	48.3	1265.2	303.7	5.00	4.17	8.57
DR7	30	-40	18.3	58.3	751.7	243.7	4.75	3.08	5.04
DR7	45	-12	18.3	30.3	2488.4	488.2	6.10	5.10	19.82
DR7	45	-20	18.3	38.3	1691.7	412.3	5.60	4.10	13.35
DR7	45	-30	18.3	48.3	1035.2	329.4	5.13	3.14	8.08
DR7	45	-40	18.3	58.3	577.7	252.6	4.82	2.29	4.48
DR7	60	-12	18.3	30.3	1853.7	545.8	6.50	3.40	18.04
DR7	60	-20	18.3	38.3	1295.9	455.7	5.87	2.84	12.43
DR7	60	-30	18.3	48.3	757.5	346.5	5.25	2.19	7.15
DR7	60	-40	18.3	58.3	358.0	252.1	4.85	1.42	3.86

Table 3-3a., Measured data of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
DR7	30	-12	18.3	30.3	2.6	0.8	0.5	4.3	2.3
DR7	30	-20	18.3	38.3	3.5	1.1	0.4	2.6	3.3
DR7	30	-30	18.3	48.3	3.8	0.5	0.4	4.1	3.9
DR7	30	-40	18.3	58.3	0.2	1.1	2.1	0.6	0.6
DR7	45	-12	18.3	30.3	1.9	1.0	0.2	2.4	2.0
DR7	45	-20	18.3	38.3	3.9	0.2	0.2	2.7	3.7
DR7	45	-30	18.3	48.3	3.4	0.6	0.6	1.7	3.2
DR7	45	-40	18.3	58.3	1.7	0.5	0.0	1.1	1.3
DR7	60	-12	18.3	30.3	3.7	0.8	0.9	1.5	3.3
DR7	60	-20	18.3	38.3	3.0	0.4	0.9	1.3	2.5
DR7	60	-30	18.3	48.3	0.4	0.5	1.0	0.3	0.7
DR7	60	-40	18.3	58.3	2.5	0.7	1.2	1.6	1.3

Table 3-3b., Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

Coefficients	Capacity (BTU/h)	Mass flow (kg)	Power input (W)
C1	8.299E+03	4.652E+01	4.892E+02
C2	2.927E+02	1.679E+00	1.110E+01
C3	-1.365E+02	-5.061E-01	7.286E-01
C4	3.417E+00	2.053E-02	1.609E-01
C5	-3.522E+00	-1.115E-02	-1.771E-02
C6	1.275E+00	6.023E-03	6.204E-02
C7	7.194E-03	5.669E-05	1.228E-03
C8	-3.417E-02	-1.043E-04	-4.309E-04
C9	7.514E-03	3.155E-05	1.324E-03
C10	-7.992E-03	-3.816E-05	-2.204E-04

Table 3-4, Coefficients C1 – C10 for NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

CURVE-FITTED CHARTS

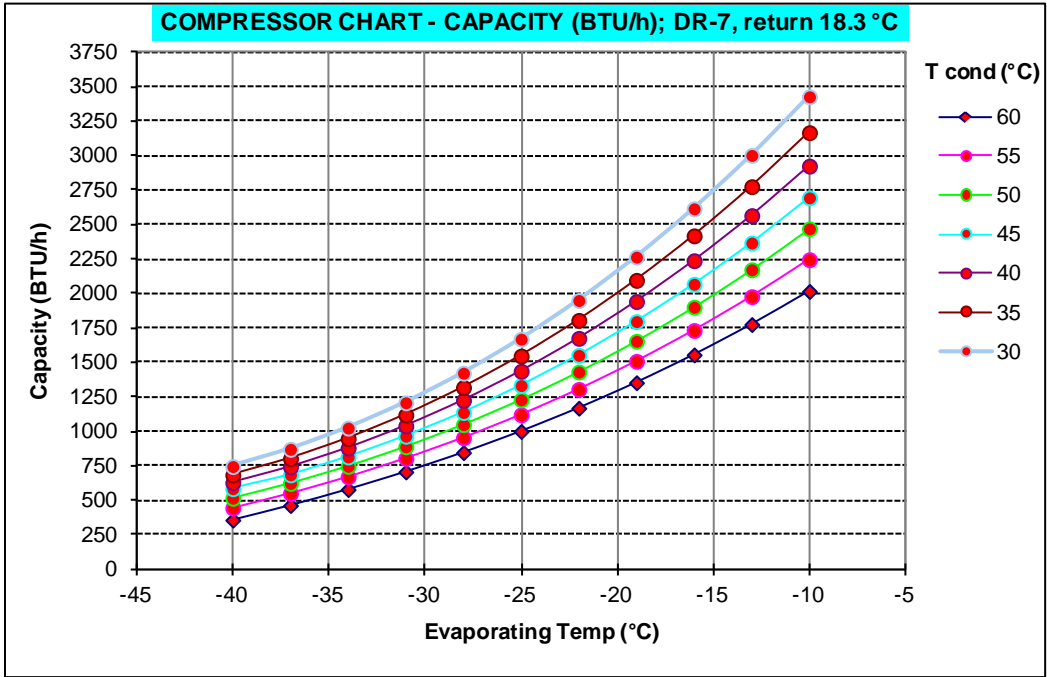


Figure 3-5, Cooling capacity of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

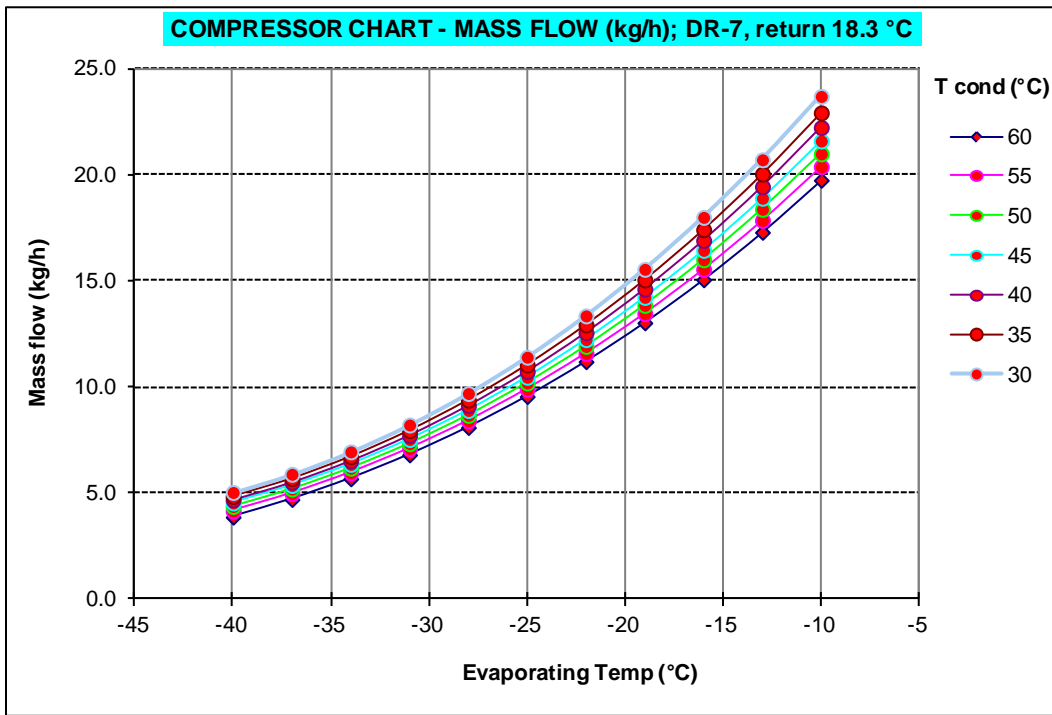


Figure 3-6, Mass flow of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

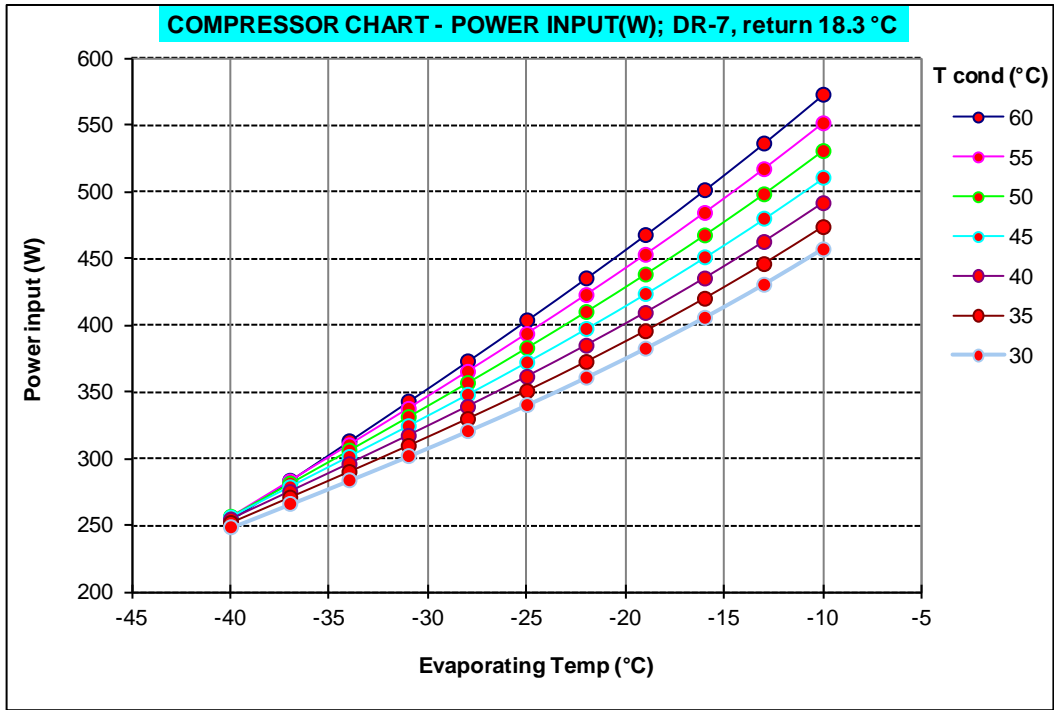


Figure 3-7, Power input of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

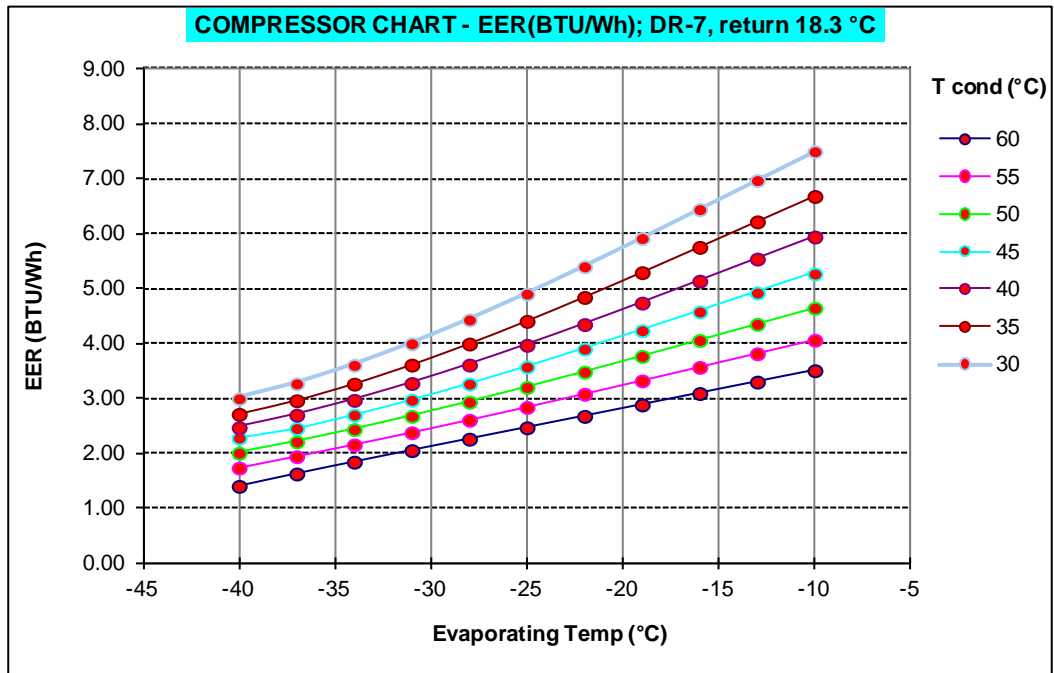


Figure 3-8, EER of NEK2134GK, refrigerant DR-7, return gas temperature 18.3 °C

### 3.1.3. Comparison of the results

**Capacity (BTU/h) DR7**

°C	60	55	50	45	40	35	30
-40	360	448	519	588	632	687	749
-37	466	554	627	689	746	806	874
-34	582	674	751	818	883	951	1028
-31	710	808	892	969	1043	1122	1211
-28	850	958	1053	1141	1229	1322	1426
-25	1003	1124	1233	1336	1440	1550	1673
-22	1172	1308	1434	1555	1678	1809	1953
-19	1357	1512	1658	1800	1945	2099	2267
-16	1559	1736	1904	2071	2241	2422	2618
-13	1779	1981	2176	2370	2568	2778	3005
-10	2019	2249	2473	2697	2927	3170	3430

**Mass Flow (kg/h) DR7**

°C	60	55	50	45	40	35	30
-40	3.85	4.14	4.35	4.52	4.66	4.82	5.01
-37	4.68	4.96	5.17	5.34	5.49	5.66	5.87
-34	5.65	5.94	6.16	6.34	6.50	6.69	6.93
-31	6.78	7.08	7.31	7.51	7.71	7.92	8.19
-28	8.07	8.39	8.65	8.88	9.11	9.36	9.68
-25	9.53	9.88	10.17	10.44	10.71	11.02	11.39
-22	11.17	11.56	11.90	12.21	12.54	12.91	13.34
-19	13.00	13.44	13.83	14.21	14.60	15.03	15.53
-16	15.03	15.53	15.98	16.42	16.89	17.39	17.98
-13	17.27	17.83	18.36	18.88	19.42	20.02	20.69
-10	19.73	20.36	20.97	21.58	22.21	22.90	23.68

**Capacity (BTU/h) R404A**

°C	60	55	50	45	40	35	30
-40	393	501	588	664	734	808	892
-37	505	619	713	795	871	951	1042
-34	622	746	849	940	1026	1115	1215
-31	747	883	998	1102	1200	1302	1415
-28	881	1032	1163	1282	1396	1513	1641
-25	1027	1196	1346	1483	1615	1751	1898
-22	1186	1377	1548	1706	1860	2017	2186
-19	1360	1576	1771	1954	2133	2314	2507
-16	1552	1795	2018	2228	2435	2644	2864
-13	1764	2037	2290	2531	2768	3008	3259
-10	1997	2303	2590	2865	3135	3408	3693

**Mass Flow (kg/h) R404A**

°C	60	55	50	45	40	35	30
-40	4.46	5.00	5.40	5.69	5.92	6.13	6.35
-37	5.67	6.19	6.57	6.84	7.06	7.25	7.46
-34	6.96	7.47	7.84	8.11	8.33	8.52	8.73
-31	8.37	8.88	9.25	9.53	9.75	9.95	10.17
-28	9.92	10.44	10.82	11.11	11.35	11.57	11.81
-25	11.62	12.16	12.57	12.89	13.15	13.40	13.68
-22	13.51	14.09	14.53	14.88	15.19	15.48	15.80
-19	15.62	16.23	16.72	17.12	17.47	17.82	18.19
-16	17.95	18.62	19.17	19.63	20.04	20.45	20.89
-13	20.55	21.29	21.90	22.42	22.91	23.39	23.91
-10	23.44	24.25	24.93	25.54	26.11	26.67	27.28

**Capacity: DR7 change relative to R404A (%)**

°C	60	55	50	45	40	35	30
-40	-8.2	-10.5	-11.8	-11.4	-13.9	-14.9	-16.0
-37	-7.6	-10.4	-12.1	-13.3	-14.3	-15.2	-16.1
-34	-6.4	-9.6	-11.6	-12.9	-13.9	-14.8	-15.5
-31	-4.9	-8.5	-10.6	-12.1	-13.1	-13.8	-14.4
-28	-3.5	-7.2	-9.5	-11.0	-12.0	-12.7	-13.1
-25	-2.3	-6.0	-8.4	-9.9	-10.9	-11.5	-11.9
-22	-1.2	-5.0	-7.3	-8.8	-9.8	-10.3	-10.7
-19	-0.3	-4.1	-6.4	-7.9	-8.8	-9.3	-9.6
-16	0.4	-3.3	-5.6	-7.1	-7.9	-8.4	-8.6
-13	0.9	-2.8	-5.0	-6.4	-7.2	-7.6	-7.8
-10	1.1	-2.4	-4.5	-5.9	-6.6	-7.0	-7.1

**Mass flow: DR7 change relative to R404A (%)**

°C	60	55	50	45	40	35	30
-40	-13.7	-17.2	-19.4	-20.6	-21.2	-21.4	-21.1
-37	-17.4	-19.8	-21.2	-22.0	-22.2	-22.0	-21.4
-34	-18.8	-20.5	-21.5	-21.9	-21.9	-21.4	-20.7
-31	-19.0	-20.3	-21.0	-21.2	-20.9	-20.4	-19.5
-28	-18.6	-19.6	-20.1	-20.1	-19.8	-19.1	-18.1
-25	-18.0	-18.8	-19.1	-19.0	-18.5	-17.8	-16.8
-22	-17.3	-17.9	-18.1	-17.9	-17.4	-16.6	-15.6
-19	-16.7	-17.2	-17.3	-17.0	-16.5	-15.7	-14.6
-16	-16.3	-16.6	-16.6	-16.3	-15.7	-14.9	-13.9
-13	-16.0	-16.2	-16.2	-15.8	-15.2	-14.4	-13.5
-10	-15.8	-16.0	-15.9	-15.5	-14.9	-14.1	-13.2

Power Input (W) DR7								EER (BTU/Wh) DR7							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	254	256	256	256	254	252	249	-40	1.42	1.75	2.02	2.30	2.49	2.73	3.01
-37	283	283	281	278	275	271	266	-37	1.65	1.96	2.23	2.47	2.71	2.98	3.28
-34	313	310	306	301	296	290	284	-34	1.86	2.17	2.45	2.72	2.99	3.28	3.62
-31	343	337	331	324	317	310	302	-31	2.07	2.39	2.69	2.99	3.29	3.63	4.01
-28	373	365	357	348	339	330	321	-28	2.28	2.62	2.95	3.28	3.63	4.01	4.45
-25	404	393	383	372	361	351	340	-25	2.49	2.86	3.22	3.59	3.99	4.42	4.92
-22	435	423	410	397	385	372	361	-22	2.69	3.10	3.50	3.92	4.36	4.86	5.41
-19	468	453	438	423	409	395	382	-19	2.90	3.34	3.78	4.25	4.75	5.31	5.93
-16	501	484	467	451	435	420	406	-16	3.11	3.58	4.07	4.59	5.15	5.77	6.45
-13	536	517	498	480	462	446	430	-13	3.32	3.83	4.37	4.94	5.55	6.23	6.98
-10	573	551	531	511	492	474	457	-10	3.52	4.08	4.66	5.28	5.96	6.69	7.51

Power Input (W) R404A								EER (BTU/Wh) R404A							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	247	254	259	263	265	265	262	-40	1.59	1.97	2.27	2.52	2.77	3.05	3.40
-37	279	284	286	287	286	284	280	-37	1.81	2.18	2.49	2.77	3.04	3.35	3.72
-34	313	315	314	313	310	305	298	-34	1.99	2.37	2.70	3.01	3.32	3.66	4.07
-31	348	347	344	339	334	327	318	-31	2.14	2.55	2.91	3.25	3.60	3.99	4.44
-28	385	380	374	367	359	350	339	-28	2.29	2.72	3.11	3.49	3.89	4.33	4.84
-25	422	414	405	395	385	373	361	-25	2.43	2.89	3.32	3.75	4.20	4.69	5.26
-22	459	448	437	424	411	397	383	-22	2.58	3.07	3.54	4.02	4.52	5.08	5.71
-19	497	483	469	454	438	422	405	-19	2.74	3.26	3.78	4.31	4.87	5.49	6.19
-16	535	518	501	483	465	447	428	-16	2.90	3.46	4.03	4.61	5.23	5.92	6.70
-13	574	554	533	513	492	471	450	-13	3.07	3.68	4.29	4.94	5.62	6.38	7.24
-10	612	589	565	542	519	496	473	-10	3.26	3.91	4.58	5.28	6.04	6.87	7.81

Power input: DR7 change relative to R404A (%)								EER: DR7 change relative to R404A (%)							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	2.9	0.7	-1.2	-2.8	-4.0	-4.9	-5.3	-40	-10.8	-11.1	-10.8	-8.9	-10.3	-10.6	-11.4
-37	1.5	-0.2	-1.8	-3.0	-4.0	-4.7	-4.9	-37	-8.9	-10.2	-10.6	-10.6	-10.8	-11.1	-11.8
-34	-0.1	-1.4	-2.6	-3.7	-4.4	-4.9	-4.9	-34	-6.3	-8.3	-9.2	-9.6	-10.0	-10.4	-11.1
-31	-1.6	-2.7	-3.6	-4.4	-5.0	-5.3	-5.2	-31	-3.4	-5.9	-7.3	-8.0	-8.5	-9.0	-9.7
-28	-3.0	-3.9	-4.6	-5.2	-5.6	-5.7	-5.5	-28	-0.5	-3.5	-5.1	-6.1	-6.8	-7.4	-8.1
-25	-4.3	-4.9	-5.5	-5.9	-6.1	-6.1	-5.7	-25	2.1	-1.2	-3.1	-4.3	-5.1	-5.8	-6.6
-22	-5.2	-5.7	-6.1	-6.4	-6.5	-6.3	-5.8	-22	4.3	0.8	-1.3	-2.6	-3.5	-4.3	-5.2
-19	-6.0	-6.3	-6.5	-6.7	-6.6	-6.3	-5.6	-19	6.0	2.4	0.1	-1.3	-2.3	-3.2	-4.2
-16	-6.4	-6.6	-6.7	-6.7	-6.5	-6.0	-5.2	-16	7.3	3.5	1.2	-0.4	-1.6	-2.6	-3.6
-13	-6.5	-6.6	-6.6	-6.4	-6.1	-5.4	-4.4	-13	7.9	4.1	1.7	0.0	-1.2	-2.3	-3.5
-10	-6.4	-6.3	-6.1	-5.8	-5.3	-4.5	-3.4	-10	8.0	4.2	1.7	0.0	-1.4	-2.6	-3.9

Table 3-5, Comparison of the results, return gas temperature 18.3 °C

### 3.2. Superheating 11.1 °C

#### 3.2.1. Reference measurement with R404A

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	BTU/h	W	A	(BTU/Wh)	kg/h
R404A	30	-12	-0.9	11.1	3112.8	464.0	5.84	6.71	26.02
R404A	30	-20	-8.9	11.1	2094.8	406.5	5.45	5.15	18.26
R404A	30	-30	-18.9	11.1	1238.6	330.5	5.01	3.75	11.32
R404A	30	-40	-28.9	11.1	690.1	264.2	4.69	2.61	6.69
R404A	45	-12	-0.9	11.1	2335.4	525.8	6.27	4.44	24.29
R404A	45	-20	-8.9	11.1	1552.6	447.3	5.71	3.47	16.96
R404A	45	-30	-18.9	11.1	894.8	351.9	5.12	2.54	10.45
R404A	45	-40	-28.9	11.1	462.0	264.8	4.69	1.75	5.82
R404A	60	-12	-0.9	11.1	1526.7	583.5	6.68	2.62	22.13
R404A	60	-20	-8.9	11.1	992.6	481.1	5.93	2.06	15.39
R404A	60	-30	-18.9	11.1	528.5	364.9	5.20	1.45	9.03
R404A	60	-40	-28.9	11.1	238.2	252.5	4.67	0.94	4.54

Table 3-6a, Measured data of NEK2134GK, refrigerant R404A, superheating 11.1°C

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
R404A	30	-12	-0.9	11.1	2.6	1.0	1.0	1.6	2.7
R404A	30	-20	-8.9	11.1	1.6	0.0	0.7	1.5	1.3
R404A	30	-30	-18.9	11.1	1.8	2.6	1.6	0.7	1.8
R404A	30	-40	-28.9	11.1	0.0	3.3	1.9	3.2	0.1
R404A	45	-12	-0.9	11.1	2.2	1.6	1.4	0.6	2.4
R404A	45	-20	-8.9	11.1	1.2	1.6	1.4	0.4	1.4
R404A	45	-30	-18.9	11.1	0.9	2.1	1.6	2.9	1.0
R404A	45	-40	-28.9	11.1	0.0	2.6	1.3	2.5	0.9
R404A	60	-12	-0.9	11.1	3.2	2.3	2.0	2.6	3.1
R404A	60	-20	-8.9	11.1	3.5	3.1	2.0	0.4	3.3
R404A	60	-30	-18.9	11.1	1.4	3.4	2.3	1.9	1.7
R404A	60	-40	-28.9	11.1	2.7	4.3	4.2	1.6	2.6

Table 3-6b, Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant R404A, superheating 11.1 °C



Coefficients	Capacity (BTU/h, °C)	Mass flow (kg/h, °C)	Power input (W, °C)
C1	8.298E+03	4.921E+01	3.491E+02
C2	3.025E+02	1.761E+00	2.883E+00
C3	-1.241E+02	-3.407E-01	7.655E+00
C4	4.329E+00	2.364E-02	-2.829E-02
C5	-2.670E+00	-6.993E-03	1.374E-01
C6	1.054E+00	4.286E-03	-3.252E-02
C7	2.020E-02	9.636E-05	-2.655E-04
C8	-2.970E-02	-9.929E-05	8.385E-04
C9	-2.365E-03	-1.872E-06	6.640E-04
C10	-8.525E-03	-3.910E-05	2.346E-04

Table 3-7, Coefficients C1 – C10 for NEK2134GK, refrigerant R404A, superheating 11.1°C

**CURVE-FITTED CHARTS**

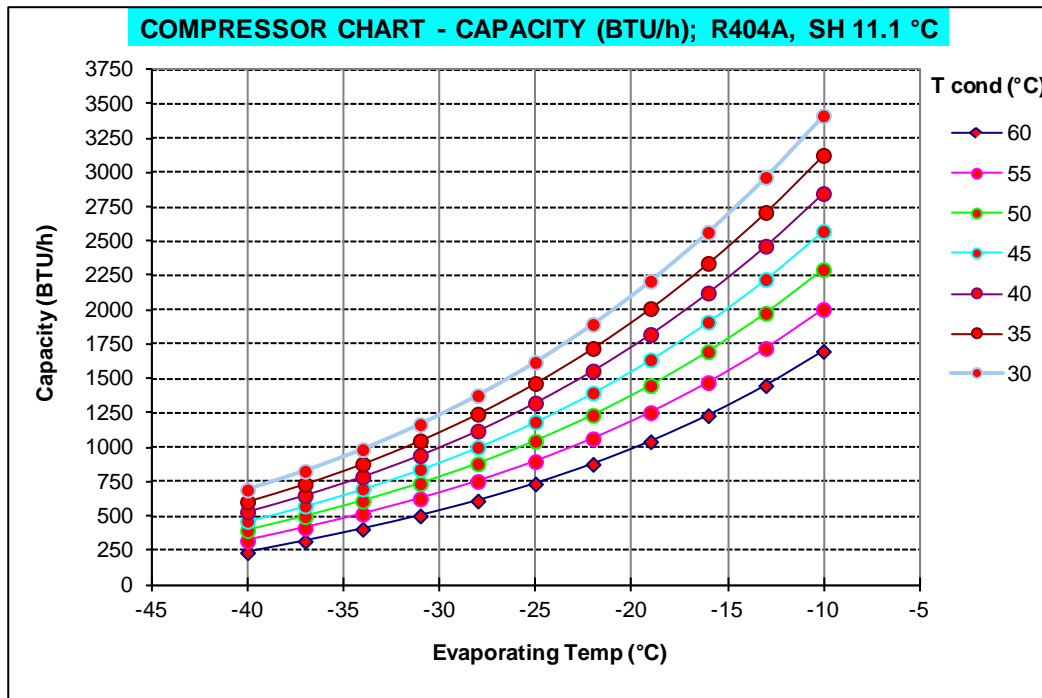


Figure 3-9, Cooling capacity of NEK2134GK, refrigerant R404A, superheating 11.1 °C

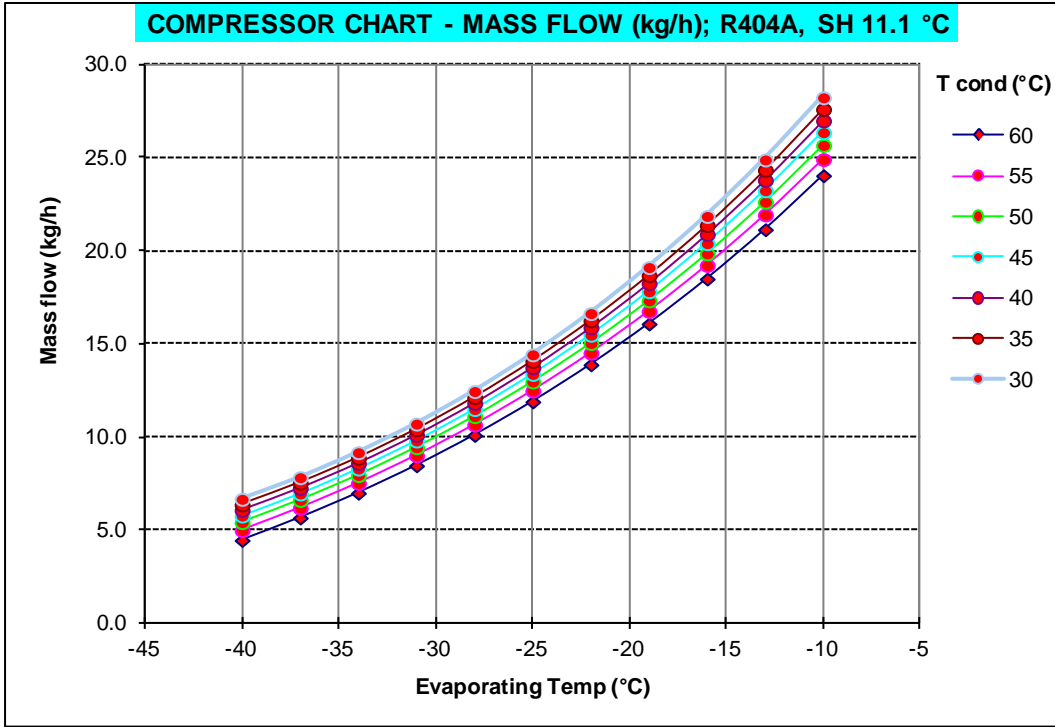


Figure 3-10, Mass flow of NEK2134GK, refrigerant R404A, superheating 11.1 °C

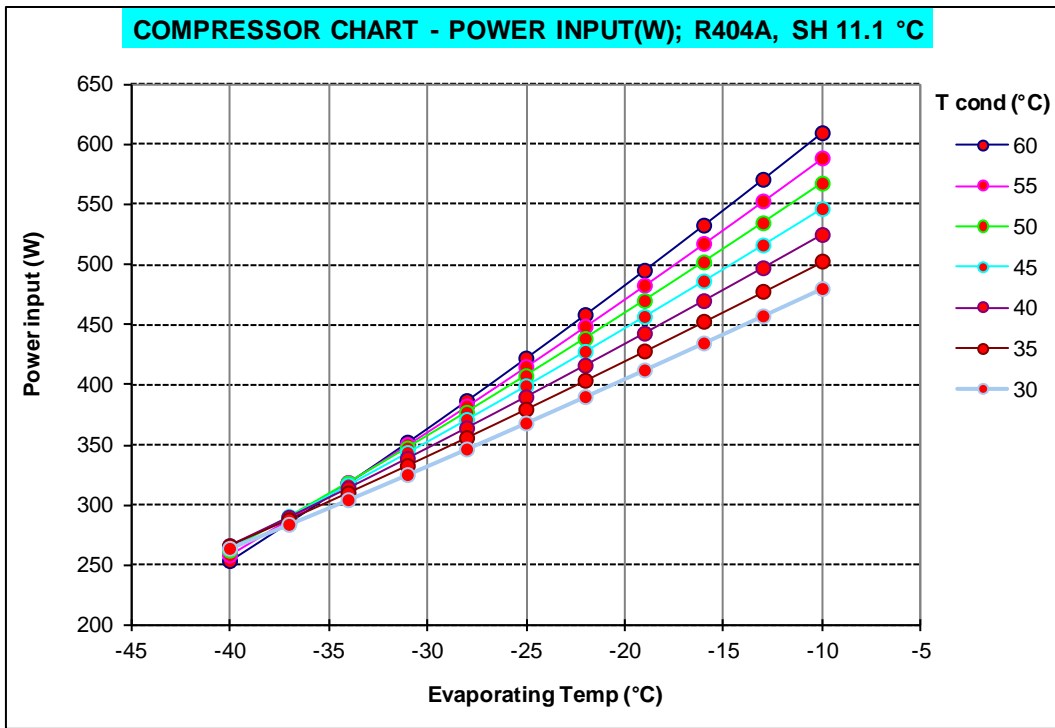


Figure 3-11, Power input of NEK2134GK, refrigerant R404A, superheating 11.1 °C

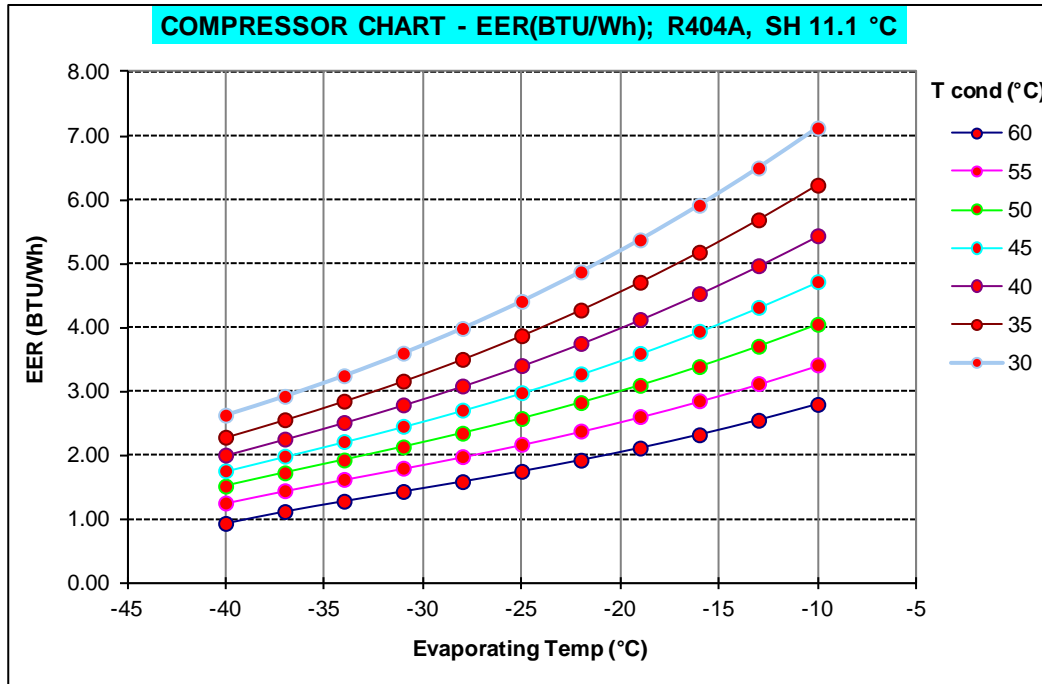


Figure 3-12, EER of NEK2134GK, refrigerant R404A, superheating 11.1 °C

### 3.2.2. Measurement with new refrigerant DR-7

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	BTU/h	W	A	(BTU/Wh)	kg/h
DR7	30	-12	-0.9	11.1	2934.7	439.6	5.80	6.68	22.34
DR7	30	-20	-8.9	11.1	1945.9	374.9	5.38	5.19	15.26
DR7	30	-30	-18.9	11.1	1055.0	306.6	5.02	3.44	8.58
DR7	30	-40	-28.9	11.1	586.8	252.2	4.82	2.33	5.11
DR7	45	-12	-0.9	11.1	2279.9	489.2	6.12	4.66	20.41
DR7	45	-20	-8.9	11.1	1486.9	413.6	5.63	3.60	13.73
DR7	45	-30	-18.9	11.1	860.2	336.1	5.19	2.56	8.40
DR7	45	-40	-28.9	11.1	449.8	254.1	4.86	1.77	4.71
DR7	60	-12	-0.9	11.1	1666.1	548.4	6.53	3.04	18.68
DR7	60	-20	-8.9	11.1	1105.1	457.8	5.91	2.41	12.85
DR7	60	-30	-18.9	11.1	602.9	350.2	5.26	1.72	7.43
DR7	60	-40	-28.9	11.1	271.4	253.2	4.87	1.07	3.94

Table 3-8a, Measured data of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
DR7	30	-12	-0.9	11.1	1.2	2.6	1.2	1.5	1.6
DR7	30	-20	-8.9	11.1	0.6	0.2	0.4	0.4	1.6
DR7	30	-30	-18.9	11.1	0.9	0.6	0.2	0.4	2.6
DR7	30	-40	-28.9	11.1	1.3	1.1	0.8	0.3	2.2
DR7	45	-12	-0.9	11.1	2.3	0.8	0.2	3.1	2.1
DR7	45	-20	-8.9	11.1	1.5	0.7	0.2	2.2	2.0
DR7	45	-30	-18.9	11.1	2.9	0.8	0.2	3.7	3.1
DR7	45	-40	-28.9	11.1	3.4	0.4	0.2	3.0	4.0
DR7	60	-12	-0.9	11.1	1.7	0.5	0.8	1.2	1.6
DR7	60	-20	-8.9	11.1	0.8	0.3	0.5	0.6	1.0
DR7	60	-30	-18.9	11.1	3.5	1.1	0.6	2.4	3.8
DR7	60	-40	-28.9	11.1	2.4	0.0	0.4	2.4	2.8

Table 3-8b., Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

Coefficients	Capacity (BTU/h)	Mass flow (kg)	Power input (W)
C1	8.419E+03	5.154E+01	4.929E+02
C2	3.178E+02	1.931E+00	1.184E+01
C3	-1.465E+02	-6.786E-01	7.963E-01
C4	4.021E+00	2.352E-02	1.749E-01
C5	-3.826E+00	-1.745E-02	-3.801E-02
C6	1.428E+00	8.446E-03	5.627E-02
C7	1.192E-02	6.312E-05	1.140E-03
C8	-3.553E-02	-1.453E-04	-8.657E-04
C9	9.267E-03	7.586E-05	1.354E-03
C10	-8.769E-03	-4.951E-05	-1.739E-04

Table 3-9, Coefficients C1 – C10 for NEK2134GK, refrigerant DR-7, superheating 11.1°C

CURVE-FITTED CHARTS

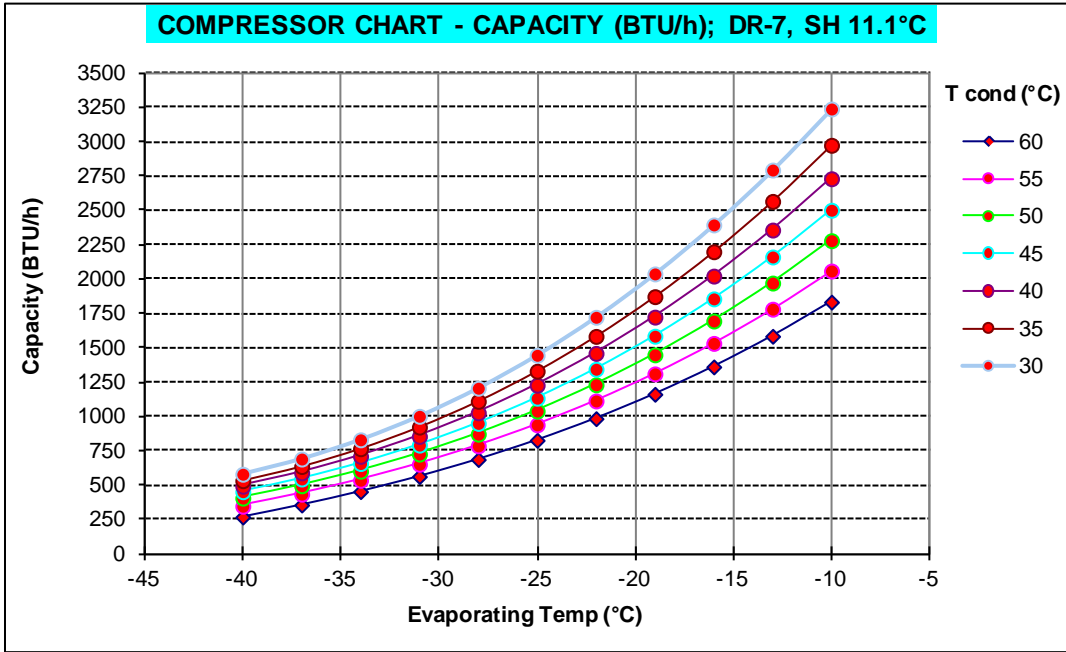


Figure 3-13, Cooling capacity of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

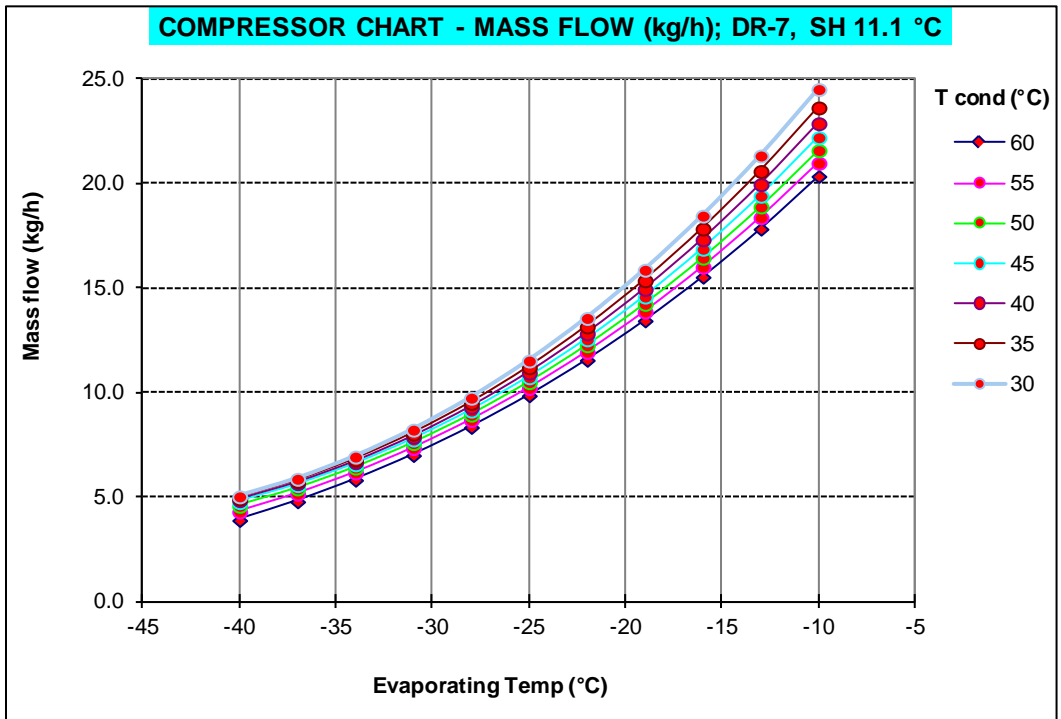


Figure 3-14, Mass flow of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

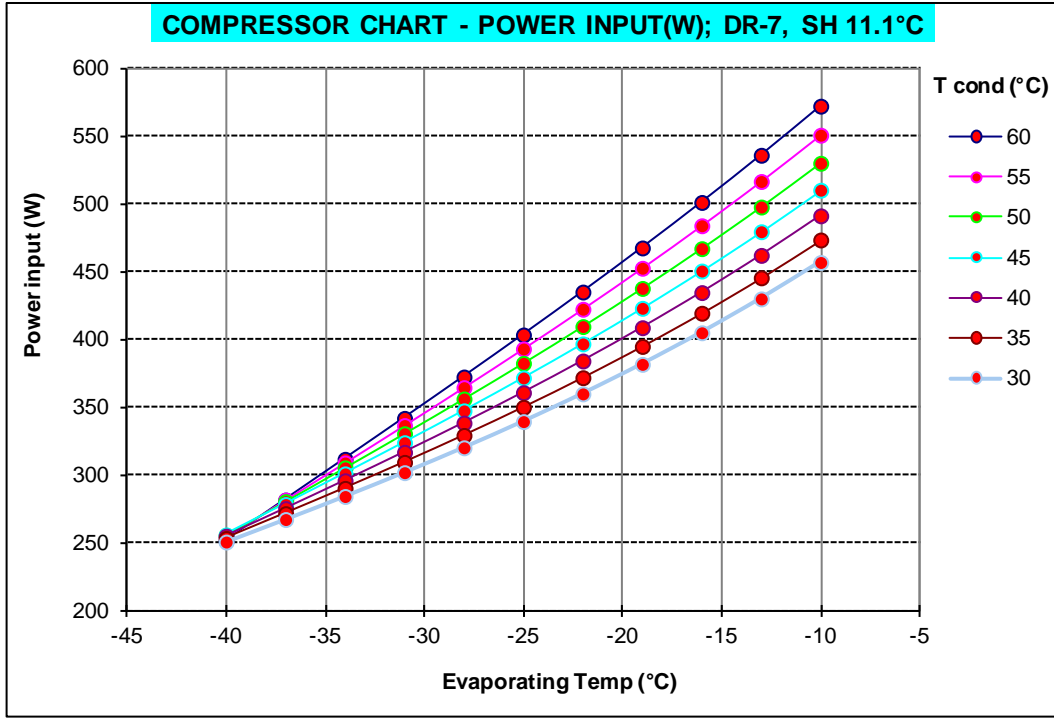


Figure 3-15, Power input of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

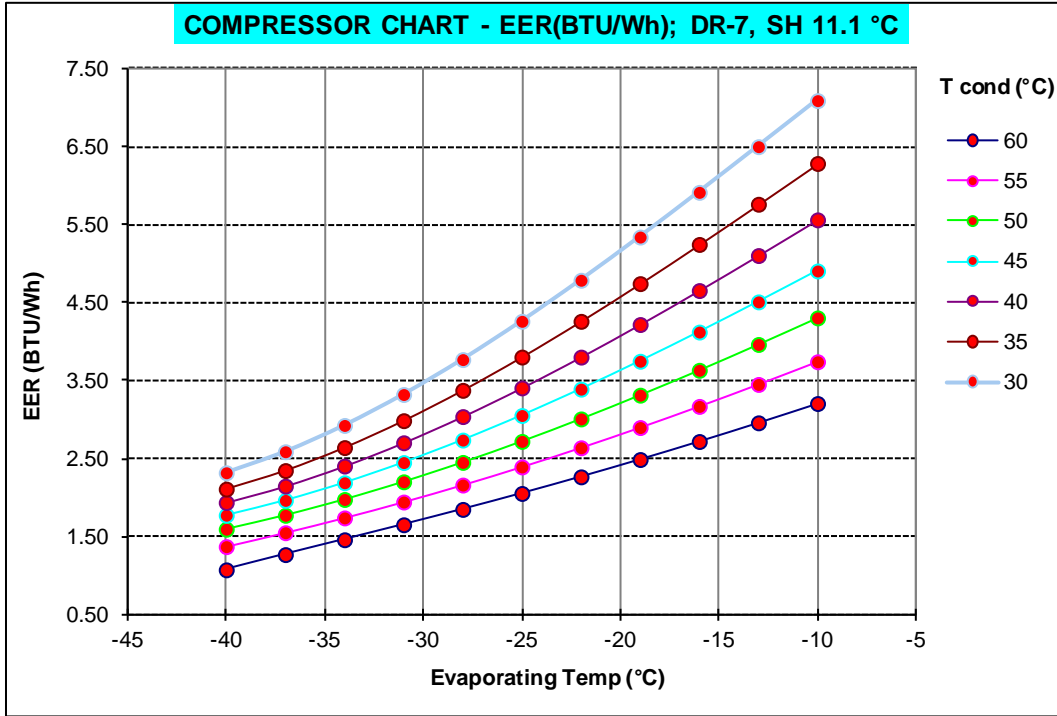


Figure 3-16, EER of NEK2134GK, refrigerant DR-7, superheating 11.1 °C

### 3.2.3. Comparison of the results

**Capacity (BTU/h) DR7**

°C	60	55	50	45	40	35	30
-40	271	349	409	455	495	535	582
-37	358	437	498	548	592	639	693
-34	456	538	604	660	713	768	833
-31	566	655	729	795	858	925	1004
-28	689	789	874	952	1030	1113	1209
-25	829	942	1042	1136	1231	1333	1448
-22	987	1116	1234	1347	1462	1586	1725
-19	1164	1313	1452	1587	1726	1875	2041
-16	1364	1535	1698	1859	2025	2202	2398
-13	1587	1784	1974	2164	2360	2569	2797
-10	1836	2062	2283	2504	2734	2977	3242

**Mass Flow (kg/h) DR7**

°C	60	55	50	45	40	35	30
-40	3.93	4.33	4.61	4.78	4.88	4.97	5.06
-37	4.82	5.19	5.44	5.59	5.70	5.79	5.90
-34	5.85	6.20	6.43	6.59	6.70	6.82	6.96
-31	7.03	7.37	7.61	7.77	7.91	8.06	8.25
-28	8.38	8.72	8.97	9.16	9.33	9.53	9.78
-25	9.89	10.25	10.52	10.76	10.98	11.24	11.56
-22	11.59	11.97	12.29	12.57	12.86	13.19	13.60
-19	13.48	13.90	14.27	14.62	14.98	15.40	15.90
-16	15.57	16.05	16.48	16.91	17.36	17.87	18.49
-13	17.87	18.42	18.93	19.44	20.00	20.63	21.37
-10	20.39	21.02	21.63	22.25	22.91	23.67	24.55

**Capacity (BTU/h) R404A**

°C	60	55	50	45	40	35	30
-40	235	322	396	464	531	605	691
-37	318	414	498	575	651	733	827
-34	406	515	611	699	787	880	985
-31	502	627	737	840	942	1049	1167
-28	611	753	881	1001	1120	1243	1378
-25	735	898	1046	1186	1324	1466	1620
-22	878	1064	1235	1397	1557	1722	1896
-19	1042	1254	1451	1638	1823	2012	2211
-16	1232	1473	1697	1912	2125	2341	2566
-13	1450	1722	1977	2223	2466	2711	2966
-10	1700	2005	2294	2573	2849	3127	3414

**Mass Flow (kg/h) R404A**

°C	60	55	50	45	40	35	30
-40	4.49	5.03	5.45	5.80	6.11	6.40	6.70
-37	5.70	6.22	6.64	6.99	7.29	7.57	7.86
-34	7.03	7.56	7.98	8.33	8.63	8.91	9.21
-31	8.50	9.04	9.47	9.83	10.14	10.44	10.74
-28	10.13	10.69	11.14	11.52	11.85	12.16	12.49
-25	11.93	12.52	13.00	13.41	13.77	14.11	14.46
-22	13.92	14.55	15.07	15.51	15.91	16.29	16.68
-19	16.12	16.79	17.36	17.85	18.29	18.71	19.15
-16	18.53	19.26	19.88	20.43	20.93	21.40	21.89
-13	21.18	21.97	22.66	23.27	23.83	24.37	24.93
-10	24.08	24.95	25.71	26.39	27.02	27.64	28.26

**Capacity: DR7 change relative to R404A (%)**

°C	60	55	50	45	40	35	30
-40	15.1	8.5	3.2	-1.9	-6.8	-11.5	-15.7
-37	12.8	5.5	0.1	-4.7	-9.0	-12.9	-16.2
-34	12.4	4.6	-1.0	-5.5	-9.4	-12.7	-15.4
-31	12.6	4.5	-1.1	-5.4	-8.9	-11.8	-14.0
-28	12.8	4.7	-0.8	-4.9	-8.0	-10.5	-12.3
-25	12.8	4.9	-0.4	-4.2	-7.1	-9.1	-10.6
-22	12.4	4.9	-0.1	-3.6	-6.1	-7.9	-9.0
-19	11.7	4.7	0.1	-3.1	-5.3	-6.8	-7.7
-16	10.7	4.2	0.0	-2.8	-4.7	-5.9	-6.6
-13	9.4	3.6	-0.2	-2.7	-4.3	-5.2	-5.7
-10	8.0	2.8	-0.5	-2.7	-4.0	-4.8	-5.0

**Mass flow: DR7 change relative to R404A (%)**

°C	60	55	50	45	40	35	30
-40	-12.6	-13.7	-15.5	-17.7	-20.1	-22.4	-24.5
-37	-15.5	-16.6	-18.2	-20.0	-21.8	-23.5	-25.0
-34	-16.8	-18.0	-19.4	-20.9	-22.3	-23.5	-24.4
-31	-17.3	-18.5	-19.7	-20.9	-22.0	-22.8	-23.2
-28	-17.3	-18.4	-19.5	-20.5	-21.2	-21.7	-21.7
-25	-17.1	-18.1	-19.1	-19.8	-20.3	-20.4	-20.1
-22	-16.8	-17.7	-18.5	-19.0	-19.2	-19.0	-18.5
-19	-16.4	-17.2	-17.8	-18.1	-18.1	-17.7	-16.9
-16	-16.0	-16.7	-17.1	-17.2	-17.0	-16.5	-15.5
-13	-15.6	-16.2	-16.5	-16.4	-16.1	-15.4	-14.3
-10	-15.3	-15.7	-15.9	-15.7	-15.2	-14.4	-13.1

Power Input (W) DR7								EER (BTU/Wh) DR7							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	252	255	256	256	256	254	251	-40	1.07	1.37	1.60	1.77	1.94	2.11	2.32
-37	282	282	281	279	276	272	268	-37	1.27	1.55	1.77	1.96	2.15	2.35	2.59
-34	312	309	306	301	296	291	285	-34	1.46	1.74	1.98	2.19	2.40	2.64	2.93
-31	342	337	331	324	317	310	302	-31	1.65	1.94	2.20	2.45	2.70	2.99	3.32
-28	373	365	357	348	339	330	321	-28	1.85	2.16	2.45	2.74	3.04	3.38	3.77
-25	404	393	383	372	361	350	340	-25	2.05	2.39	2.72	3.05	3.41	3.80	4.26
-22	435	423	410	397	385	372	360	-22	2.27	2.64	3.01	3.39	3.80	4.26	4.79
-19	468	453	438	423	409	395	382	-19	2.49	2.90	3.31	3.75	4.22	4.74	5.34
-16	501	484	467	451	435	420	405	-16	2.72	3.17	3.63	4.12	4.65	5.25	5.91
-13	536	517	498	480	462	446	430	-13	2.96	3.45	3.96	4.51	5.10	5.76	6.50
-10	572	551	530	511	492	474	457	-10	3.21	3.74	4.30	4.91	5.56	6.28	7.09

Power Input (W) R404A								EER (BTU/Wh) R404A							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	254	258	262	265	266	266	264	-40	0.93	1.25	1.51	1.75	2.00	2.28	2.62
-37	285	288	290	290	290	287	284	-37	1.11	1.44	1.72	1.98	2.25	2.55	2.92
-34	318	319	318	316	314	310	304	-34	1.27	1.62	1.92	2.21	2.51	2.84	3.24
-31	352	350	347	343	339	333	325	-31	1.43	1.79	2.12	2.45	2.78	3.15	3.59
-28	387	382	377	371	364	356	346	-28	1.58	1.97	2.34	2.70	3.08	3.49	3.98
-25	422	415	407	399	390	379	368	-25	1.74	2.16	2.57	2.97	3.40	3.87	4.40
-22	458	448	438	427	416	403	390	-22	1.92	2.37	2.82	3.27	3.74	4.27	4.86
-19	495	483	470	457	443	428	412	-19	2.11	2.60	3.09	3.59	4.12	4.70	5.37
-16	532	517	502	486	470	453	434	-16	2.31	2.85	3.38	3.93	4.52	5.17	5.91
-13	571	553	534	516	497	477	457	-13	2.54	3.12	3.70	4.31	4.96	5.68	6.49
-10	609	588	567	546	525	503	480	-10	2.79	3.41	4.04	4.71	5.43	6.22	7.12

Power input: DR7 change relative to R404A (%)								EER: DR7 change relative to R404A (%)							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	-0.6	-1.4	-2.3	-3.2	-3.9	-4.5	-4.8	-40	15.8	10.0	5.6	1.3	-3.0	-7.3	-11.5
-37	-1.2	-2.1	-3.0	-4.0	-4.8	-5.3	-5.6	-37	14.1	7.7	3.2	-0.8	-4.4	-8.0	-11.3
-34	-1.9	-2.9	-3.8	-4.8	-5.6	-6.1	-6.4	-34	14.6	7.7	2.9	-0.8	-4.1	-7.0	-9.7
-31	-2.8	-3.7	-4.6	-5.5	-6.3	-6.8	-7.0	-31	15.8	8.5	3.7	0.1	-2.8	-5.3	-7.5
-28	-3.6	-4.5	-5.4	-6.2	-6.9	-7.3	-7.4	-28	17.0	9.6	4.8	1.4	-1.3	-3.4	-5.3
-25	-4.3	-5.1	-6.0	-6.7	-7.3	-7.6	-7.6	-25	17.8	10.6	5.9	2.7	0.3	-1.6	-3.2
-22	-4.9	-5.7	-6.4	-7.1	-7.5	-7.7	-7.6	-22	18.3	11.2	6.8	3.7	1.5	-0.2	-1.6
-19	-5.5	-6.1	-6.7	-7.2	-7.6	-7.6	-7.3	-19	18.1	11.5	7.3	4.5	2.4	0.9	-0.5
-16	-5.8	-6.4	-6.9	-7.2	-7.4	-7.2	-6.7	-16	17.5	11.3	7.4	4.8	2.9	1.4	0.1
-13	-6.0	-6.4	-6.8	-7.0	-7.0	-6.6	-5.8	-13	16.4	10.8	7.1	4.7	2.9	1.5	0.1
-10	-6.0	-6.3	-6.5	-6.5	-6.3	-5.7	-4.7	-10	14.9	9.8	6.4	4.1	2.4	1.0	-0.4

Table 3-10, Comparison of the results, superheating 11.1 °C



### 3.3. Superheating 22.2 °C

#### 3.3.1. Reference measurement with R404A

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	BTU/h	W	A	(BTU/Wh)	kg/h
R404A	30	-12	10.2	22.2	3299.6	463.0	5.83	7.13	25.61
R404A	30	-20	2.2	22.2	2223.8	403.1	5.44	5.52	17.90
R404A	30	-30	-7.8	22.2	1286.5	328.2	5.00	3.92	10.91
R404A	30	-40	-17.8	22.2	724.6	262.9	4.68	2.76	6.49
R404A	45	-12	10.2	22.2	2511.8	523.6	6.24	4.80	24.09
R404A	45	-20	2.2	22.2	1679.2	445.4	5.69	3.77	16.69
R404A	45	-30	-7.8	22.2	980.3	351.2	5.12	2.79	10.36
R404A	45	-40	-17.8	22.2	510.8	262.8	4.67	1.94	5.81
R404A	60	-12	10.2	22.2	1716.3	584.8	6.68	2.93	21.84
R404A	60	-20	2.2	22.2	1118.3	480.5	5.93	2.33	15.18
R404A	60	-30	-7.8	22.2	596.3	358.7	5.15	1.66	8.84
R404A	60	-40	-17.8	22.2	273.1	246.8	4.62	1.11	4.46

Table 3-11a, Measured data of NEK2134GK, refrigerant R404A, superheating 22.2 °C

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
R404A	30	-12	10.2	22.2	2.4	0.3	0.9	2.1	2.5
R404A	30	-20	2.2	22.2	1.5	0.0	0.9	1.4	1.4
R404A	30	-30	-7.8	22.2	2.0	2.2	1.4	4.1	2.0
R404A	30	-40	-17.8	22.2	1.7	1.8	1.5	0.2	1.2
R404A	45	-12	10.2	22.2	1.9	1.6	1.3	0.3	2.6
R404A	45	-20	2.2	22.2	1.9	1.9	1.8	0.1	2.0
R404A	45	-30	-7.8	22.2	0.9	2.8	1.8	3.6	0.7
R404A	45	-40	-17.8	22.2	1.3	2.3	1.3	3.5	1.5
R404A	60	-12	10.2	22.2	3.1	2.4	1.7	0.7	3.1
R404A	60	-20	2.2	22.2	2.7	2.6	1.9	0.1	2.8
R404A	60	-30	-7.8	22.2	2.5	3.8	2.2	1.3	2.5
R404A	60	-40	-17.8	22.2	1.6	3.7	2.2	3.0	1.6

Table 3-11b., Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant R404A, superheating 22.2 °C

Coefficients	Capacity (BTU/h, °C)	Mass flow (kg, °C)	Power input (W, °C)
C1	8.572E+03	4.858E+01	3.868E+02
C2	3.206E+02	1.838E+00	3.480E+00
C3	-1.189E+02	-3.140E-01	5.000E+00
C4	4.249E+00	2.550E-02	-5.375E-02
C5	-3.191E+00	-8.308E-03	7.891E-02
C6	8.157E-01	4.060E-03	1.670E-02
C7	1.671E-02	1.102E-04	-7.084E-04
C8	-3.125E-02	-1.092E-04	7.155E-04
C9	2.459E-03	5.844E-06	1.349E-03
C10	-6.092E-03	-4.050E-05	-2.527E-05

Table 3-12, Coefficients C1 – C10 for NEK2134GK, refrigerant R404A, superheating 22.2 °C

**CURVE-FITTED CHARTS**

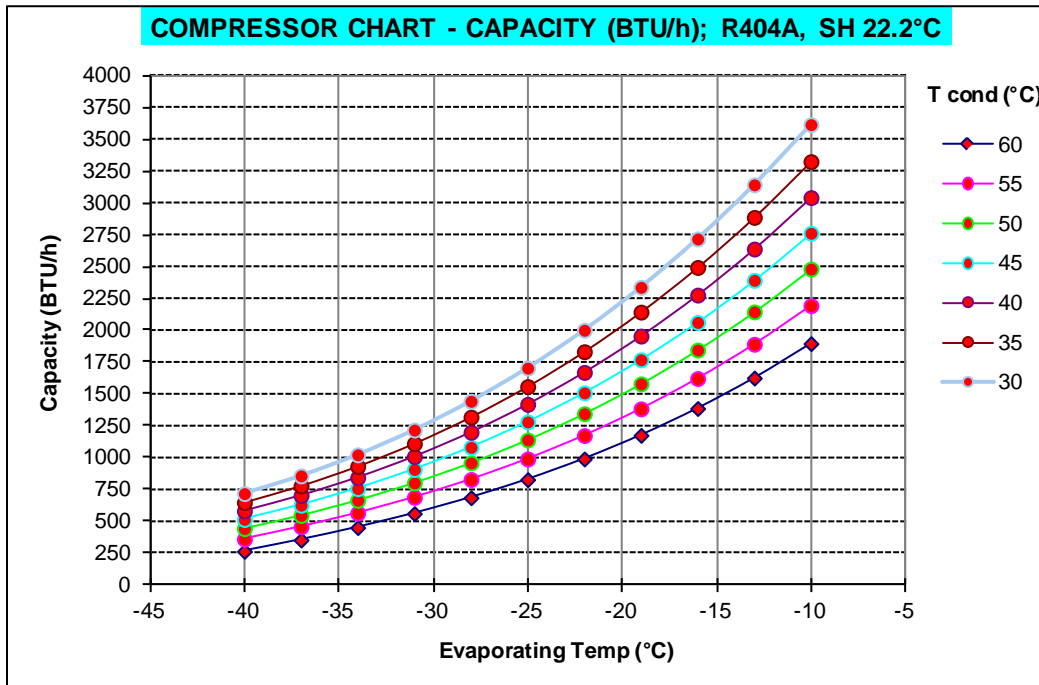


Figure 3-17, Cooling capacity of NEK2134GK, refrigerant R404A, superheating 22.2 °C

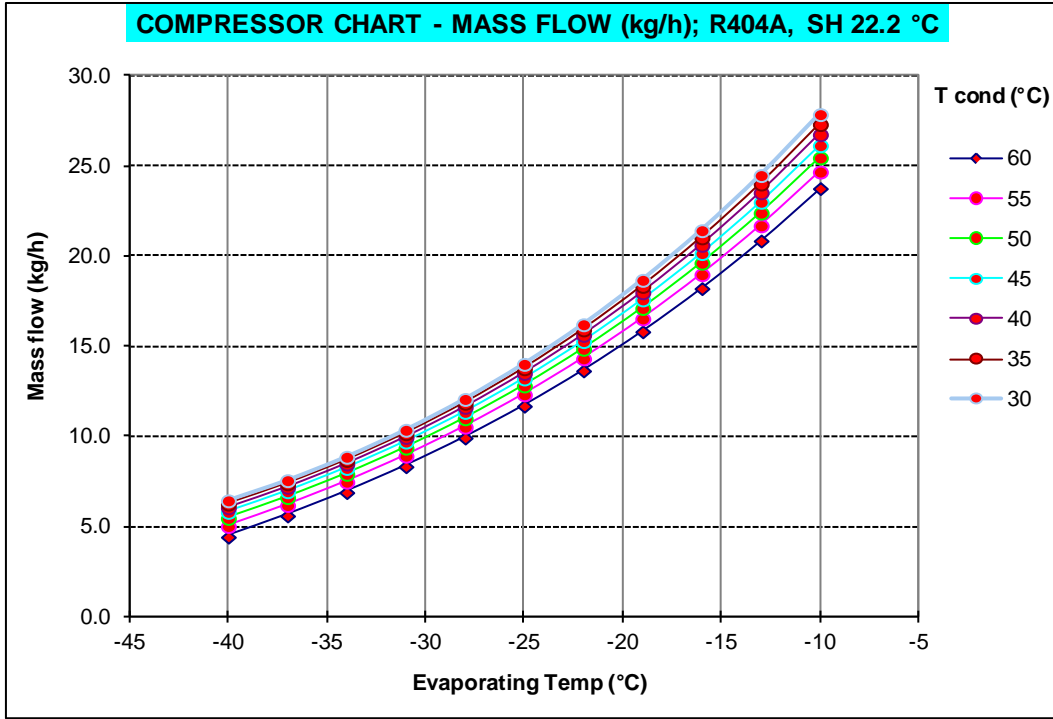


Figure 3-18, Mass flow of NEK2134GK, refrigerant R404A, superheating 22.2 °C

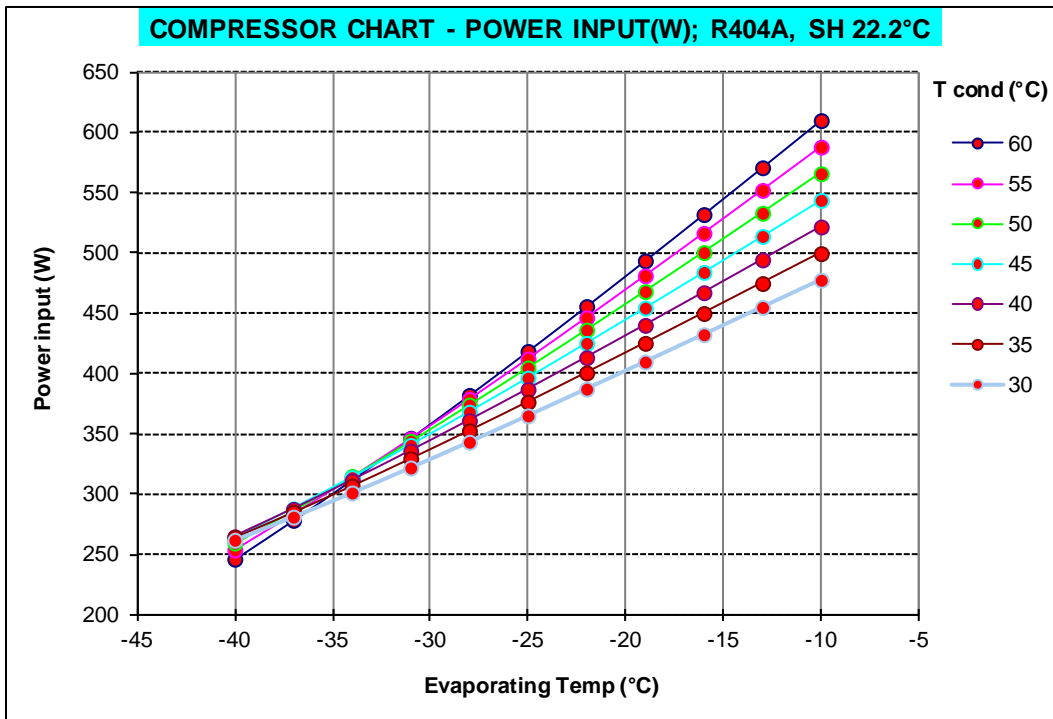


Figure 3-19, Power input of NEK2134GK, refrigerant R404A, superheating 22.2 °C

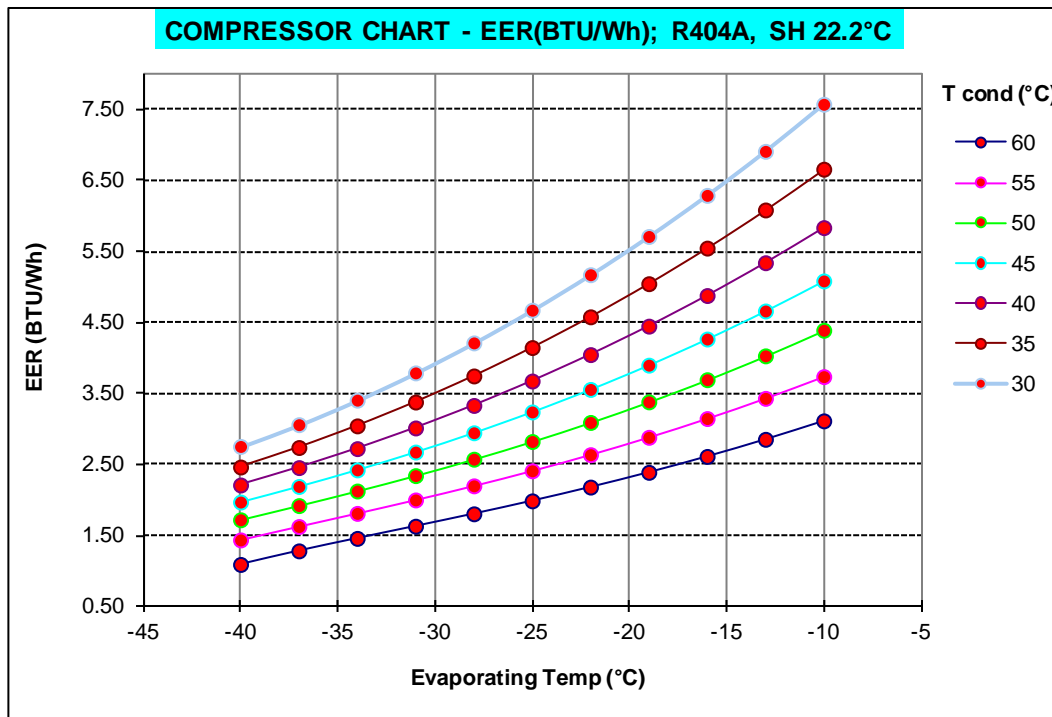


Figure 3-20, EER of NEK2134GK, refrigerant R404A, superheating 22.2 °C

### 3.3.2. Measurement with new refrigerant DR-7

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	BTU/h	W	A	(BTU/Wh)	kg/h
DR7	30	-12	10.2	22.2	3067.0	426.9	5.71	7.18	21.98
DR7	30	-20	2.2	22.2	2039.4	374.8	5.38	5.44	15.07
DR7	30	-30	-7.8	22.2	1146.8	308.0	5.13	3.72	8.64
DR7	30	-40	-17.8	22.2	643.0	248.2	4.81	2.59	5.21
DR7	45	-12	10.2	22.2	2410.2	488.3	6.11	4.94	20.11
DR7	45	-20	2.2	22.2	1585.2	413.1	5.62	3.84	13.67
DR7	45	-30	-7.8	22.2	919.5	333.5	5.16	2.76	8.29
DR7	45	-40	-17.8	22.2	501.1	249.9	4.85	2.01	4.59
DR7	60	-12	10.2	22.2	1801.9	547.4	6.52	3.29	18.55
DR7	60	-20	2.2	22.2	1178.2	456.0	5.89	2.58	12.60
DR7	60	-30	-7.8	22.2	664.3	348.8	5.26	1.90	7.51
DR7	60	-40	-17.8	22.2	301.1	251.2	4.87	1.20	3.91

Table 3-13a, Measured data of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

AVERAGE	T cond (dew)	T evap (dew)	T return gas	T Superheat	Cool. Capacity	Power input	Current	EER	Mass flow
REFRIGERANT	(°C)	(°C)	(°C)	(°C)	%	%	%	%	%
DR7	30	-12	10.2	22.2	1.3	0.1	0.5	1.4	2.8
DR7	30	-20	2.2	22.2	2.2	0.9	0.2	3.2	2.3
DR7	30	-30	-7.8	22.2	2.4	0.9	0.8	3.3	3.3
DR7	30	-40	-17.8	22.2	1.1	1.2	1.2	0.1	1.6
DR7	45	-12	10.2	22.2	1.9	0.8	0.2	2.7	2.2
DR7	45	-20	2.2	22.2	3.8	1.3	2.0	2.4	3.9
DR7	45	-30	-7.8	22.2	2.4	1.3	0.2	3.8	2.5
DR7	45	-40	-17.8	22.2	0.2	1.3	0.0	1.5	2.0
DR7	60	-12	10.2	22.2	2.4	0.6	0.8	1.8	2.4
DR7	60	-20	2.2	22.2	2.0	0.7	1.0	1.2	2.2
DR7	60	-30	-7.8	22.2	2.3	1.1	0.4	1.2	2.3
DR7	60	-40	-17.8	22.2	2.4	1.4	1.2	3.7	2.5

Table 3-13b., Difference (abs %) between 2 measured pieces of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

Coefficients	Capacity (BTU/h)	Mass flow (kg)	Power input (W)
C1	8.744E+03	4.857E+01	3.371E+02
C2	3.332E+02	1.879E+00	2.924E+00
C3	-1.513E+02	-5.265E-01	5.967E+00
C4	4.673E+00	2.618E-02	2.866E-02
C5	-3.652E+00	-1.354E-02	1.671E-01
C6	1.583E+00	5.927E-03	2.200E-03
C7	2.110E-02	1.107E-04	5.562E-04
C8	-3.258E-02	-1.319E-04	9.426E-04
C9	9.425E-03	4.396E-05	2.329E-04
C10	-9.907E-03	-3.498E-05	-6.443E-06

Table 3-14, Coefficients C1 – C10 for NEK2134GK, refrigerant DR-7, superheating 22.2 °C

CURVE-FITTED CHARTS

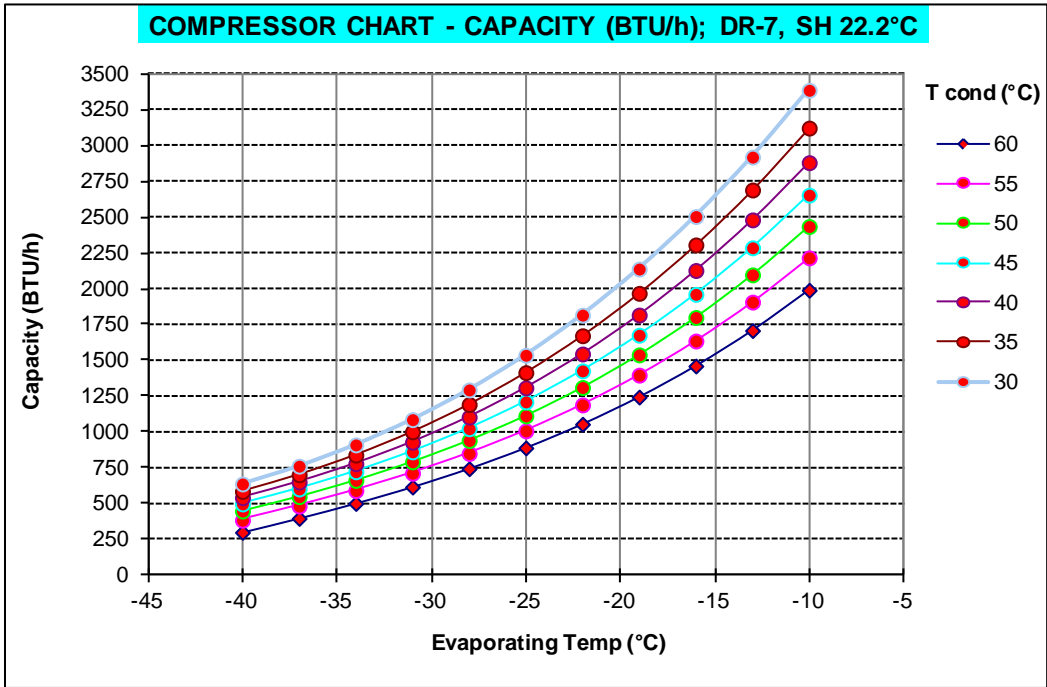


Figure 3-21, Cooling capacity of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

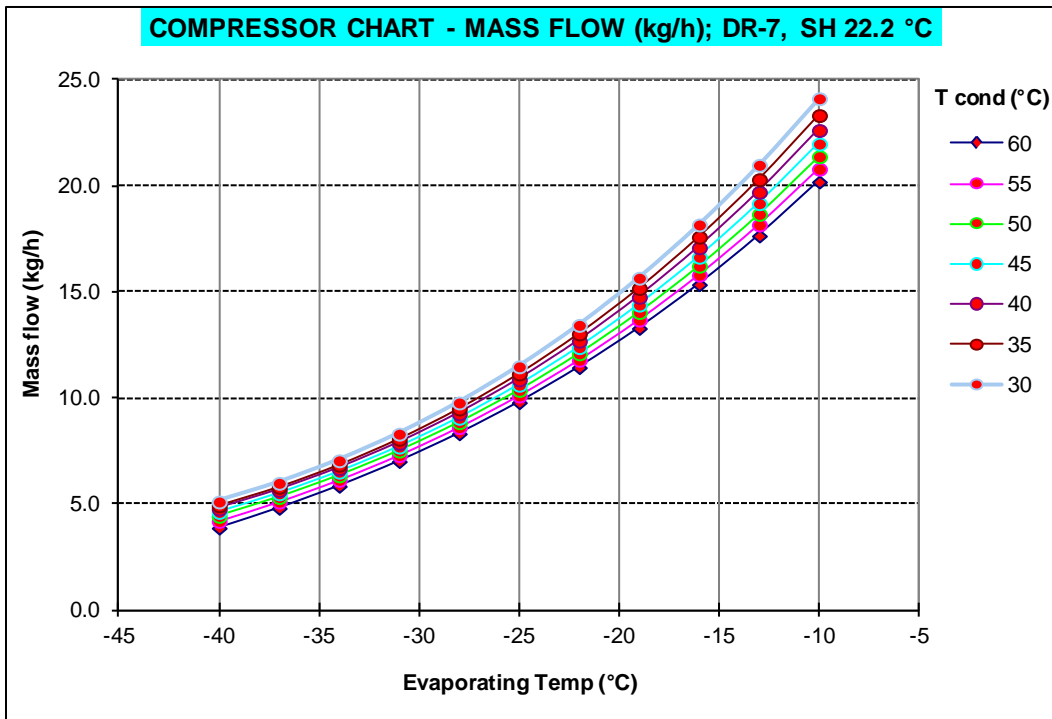


Figure 3-22, Mass flow of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

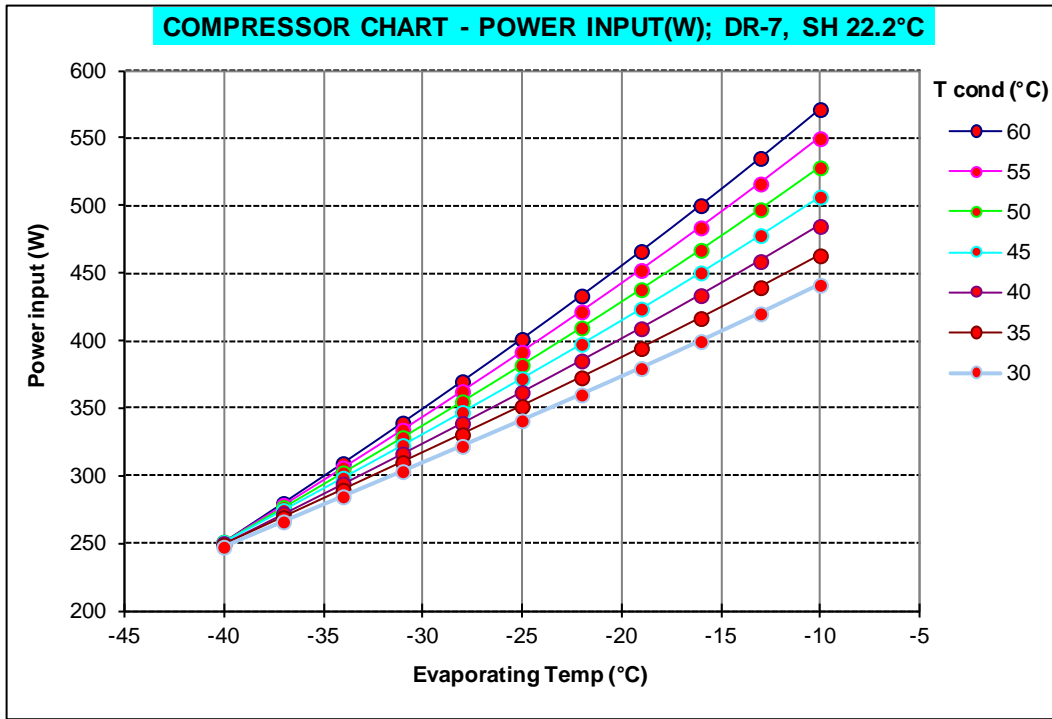


Figure 3-23, Power input of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

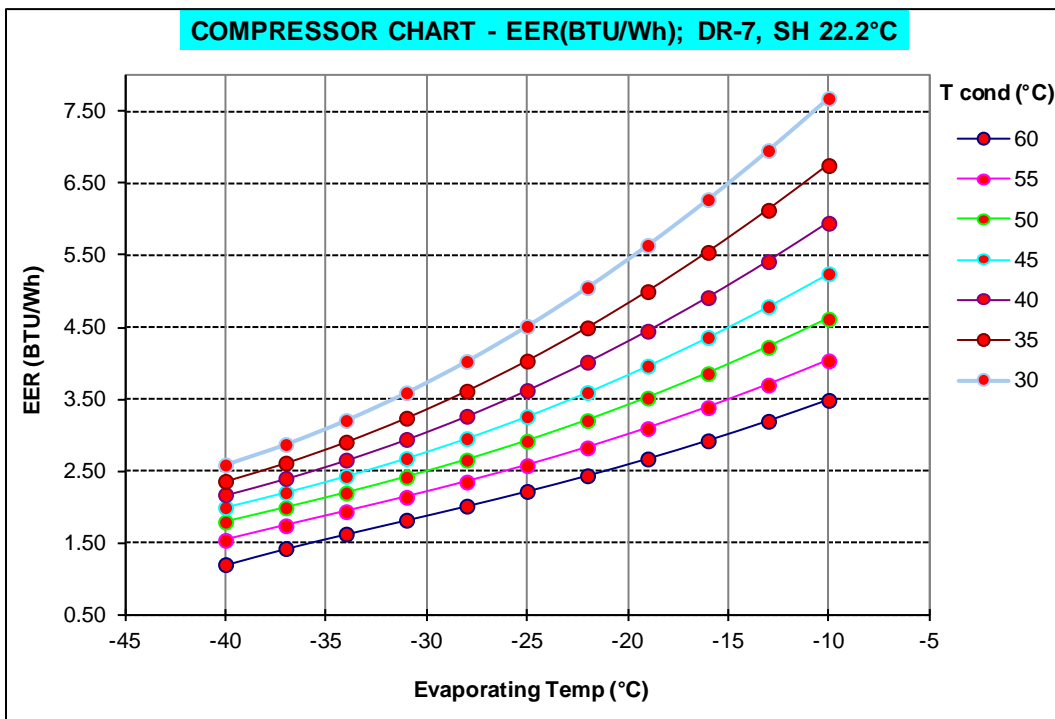


Figure 3-24, EER of NEK2134GK, refrigerant DR-7, superheating 22.2 °C

### 3.3.3. Comparison of the results

Capacity (BTU/h)

DR7

°C	60	55	50	45	40	35	30
-40	303	388	452	501	545	589	641
-37	400	486	552	606	654	705	765
-34	505	594	666	726	782	842	913
-31	619	716	795	865	932	1005	1090
-28	747	853	944	1026	1107	1195	1297
-25	892	1011	1116	1213	1312	1418	1539
-22	1058	1192	1314	1430	1548	1675	1819
-19	1247	1400	1542	1679	1820	1971	2141
-16	1464	1638	1803	1964	2131	2309	2507
-13	1711	1910	2100	2289	2484	2692	2922
-10	1993	2219	2438	2657	2883	3124	3388

Mass Flow (kg/h)

DR7

°C	60	55	50	45	40	35	30
-40	3.91	4.23	4.47	4.65	4.81	4.96	5.14
-37	4.84	5.14	5.36	5.53	5.68	5.84	6.03
-34	5.88	6.16	6.38	6.55	6.71	6.88	7.09
-31	7.05	7.33	7.55	7.73	7.91	8.10	8.34
-28	8.36	8.65	8.88	9.09	9.30	9.53	9.81
-25	9.83	10.14	10.41	10.65	10.90	11.18	11.52
-22	11.48	11.82	12.13	12.42	12.72	13.07	13.47
-19	13.33	13.72	14.08	14.43	14.80	15.21	15.69
-16	15.39	15.84	16.26	16.68	17.13	17.63	18.20
-13	17.68	18.20	18.70	19.21	19.74	20.34	21.02
-10	20.23	20.83	21.42	22.02	22.66	23.36	24.15

Capacity (BTU/h)

R404A

°C	60	55	50	45	40	35	30
-40	269	365	447	519	586	652	722
-37	357	461	551	631	706	781	861
-34	455	569	669	761	848	935	1026
-31	565	692	806	911	1012	1114	1220
-28	689	833	963	1085	1203	1322	1446
-25	831	994	1143	1284	1423	1562	1707
-22	994	1177	1349	1513	1673	1836	2004
-19	1179	1387	1583	1772	1958	2147	2341
-16	1390	1625	1849	2066	2280	2497	2721
-13	1629	1894	2148	2396	2642	2890	3146
-10	1899	2197	2485	2766	3045	3328	3618

Mass Flow (kg/h)

R404A

°C	60	55	50	45	40	35	30
-40	4.47	5.06	5.51	5.85	6.10	6.30	6.48
-37	5.64	6.22	6.66	6.99	7.23	7.43	7.60
-34	6.94	7.52	7.96	8.28	8.53	8.72	8.90
-31	8.38	8.96	9.41	9.74	10.00	10.21	10.40
-28	9.97	10.57	11.03	11.39	11.67	11.90	12.11
-25	11.73	12.36	12.86	13.24	13.55	13.81	14.05
-22	13.69	14.36	14.89	15.31	15.66	15.96	16.25
-19	15.86	16.57	17.15	17.63	18.02	18.38	18.71
-16	18.25	19.03	19.66	20.20	20.65	21.07	21.47
-13	20.89	21.74	22.44	23.04	23.57	24.05	24.52
-10	23.80	24.72	25.50	26.18	26.79	27.35	27.90

Capacity: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	12.7	6.3	1.1	-3.3	-7.0	-9.7	-11.2
-37	12.1	5.5	0.3	-4.0	-7.4	-9.8	-11.1
-34	10.9	4.5	-0.6	-4.6	-7.7	-9.9	-11.0
-31	9.6	3.4	-1.3	-5.1	-7.9	-9.8	-10.7
-28	8.4	2.5	-2.0	-5.4	-7.9	-9.6	-10.3
-25	7.3	1.8	-2.4	-5.5	-7.8	-9.2	-9.8
-22	6.4	1.3	-2.6	-5.5	-7.5	-8.8	-9.2
-19	5.8	0.9	-2.6	-5.3	-7.1	-8.2	-8.6
-16	5.3	0.8	-2.5	-4.9	-6.6	-7.5	-7.9
-13	5.1	0.8	-2.2	-4.5	-6.0	-6.8	-7.1
-10	4.9	1.0	-1.9	-4.0	-5.3	-6.1	-6.4

Current: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	-12.5	-16.4	-18.9	-20.4	-21.2	-21.2	-20.7
-37	-14.2	-17.5	-19.6	-20.9	-21.5	-21.4	-20.7
-34	-15.2	-18.0	-19.8	-20.9	-21.3	-21.2	-20.4
-31	-15.8	-18.2	-19.8	-20.6	-20.9	-20.6	-19.8
-28	-16.1	-18.2	-19.5	-20.2	-20.3	-19.9	-19.0
-25	-16.2	-18.0	-19.1	-19.6	-19.6	-19.1	-18.0
-22	-16.2	-17.6	-18.5	-18.9	-18.8	-18.2	-17.1
-19	-16.0	-17.2	-17.9	-18.2	-17.9	-17.2	-16.1
-16	-15.7	-16.8	-17.3	-17.4	-17.1	-16.3	-15.2
-13	-15.4	-16.3	-16.7	-16.6	-16.2	-15.4	-14.3
-10	-15.0	-15.7	-16.0	-15.9	-15.4	-14.6	-13.4



Power Input (W) DR7								EER (BTU/Wh) DR7							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	251	251	251	251	250	249	248	-40	1.21	1.54	1.80	2.00	2.18	2.36	2.59
-37	280	279	277	275	272	269	266	-37	1.43	1.75	2.00	2.21	2.40	2.62	2.87
-34	309	306	303	299	294	290	285	-34	1.63	1.94	2.20	2.43	2.66	2.91	3.21
-31	339	334	329	323	317	310	303	-31	1.82	2.14	2.42	2.68	2.94	3.24	3.59
-28	370	363	355	347	339	331	322	-28	2.02	2.35	2.66	2.95	3.26	3.61	4.03
-25	401	392	382	372	362	352	341	-25	2.22	2.58	2.92	3.26	3.62	4.03	4.51
-22	434	422	410	398	385	373	360	-22	2.44	2.83	3.21	3.59	4.02	4.49	5.05
-19	467	453	438	424	409	395	380	-19	2.67	3.09	3.52	3.96	4.45	4.99	5.64
-16	501	484	467	451	434	417	400	-16	2.92	3.38	3.86	4.36	4.91	5.54	6.27
-13	536	517	498	478	459	440	420	-13	3.20	3.70	4.22	4.78	5.41	6.12	6.95
-10	572	550	529	507	485	463	442	-10	3.49	4.03	4.61	5.24	5.94	6.74	7.67

Power Input (W) R404A								EER (BTU/Wh) R404A							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	247	254	260	264	265	265	262	-40	1.09	1.43	1.72	1.97	2.21	2.46	2.75
-37	279	284	287	288	288	286	282	-37	1.28	1.62	1.92	2.19	2.45	2.74	3.06
-34	312	315	315	314	312	307	302	-34	1.46	1.81	2.12	2.42	2.72	3.04	3.40
-31	347	346	344	341	336	330	322	-31	1.63	2.00	2.34	2.67	3.01	3.38	3.79
-28	382	379	374	369	361	353	344	-28	1.80	2.20	2.57	2.94	3.33	3.74	4.21
-25	419	413	405	397	387	377	365	-25	1.98	2.41	2.82	3.24	3.67	4.14	4.67
-22	456	447	437	426	414	401	388	-22	2.18	2.64	3.09	3.55	4.04	4.58	5.17
-19	494	482	469	455	441	426	410	-19	2.39	2.88	3.38	3.90	4.45	5.04	5.71
-16	532	517	501	484	468	450	433	-16	2.61	3.14	3.69	4.26	4.88	5.54	6.29
-13	571	552	533	514	495	475	455	-13	2.85	3.43	4.03	4.66	5.34	6.08	6.91
-10	610	588	566	544	522	500	478	-10	3.11	3.73	4.39	5.08	5.83	6.66	7.57

Power input: DR7 change relative to R404A (%)								EER: DR7 change relative to R404A (%)							
°C	60	55	50	45	40	35	30	°C	60	55	50	45	40	35	30
-40	1.7	-1.2	-3.3	-4.8	-5.6	-5.9	-5.6	-40	10.8	7.6	4.6	1.5	-1.4	-4.0	-5.9
-37	0.4	-1.9	-3.6	-4.7	-5.4	-5.7	-5.4	-37	11.7	7.6	4.0	0.8	-2.1	-4.4	-6.0
-34	-0.9	-2.7	-4.0	-5.0	-5.5	-5.7	-5.5	-34	12.0	7.4	3.6	0.4	-2.3	-4.4	-5.8
-31	-2.1	-3.5	-4.6	-5.3	-5.8	-6.0	-5.8	-31	12.0	7.2	3.4	0.3	-2.3	-4.1	-5.2
-28	-3.2	-4.3	-5.1	-5.8	-6.1	-6.3	-6.2	-28	12.0	7.1	3.3	0.4	-1.9	-3.5	-4.4
-25	-4.2	-5.0	-5.7	-6.2	-6.5	-6.7	-6.7	-25	12.0	7.1	3.5	0.7	-1.4	-2.7	-3.4
-22	-4.9	-5.6	-6.1	-6.5	-6.8	-7.0	-7.1	-22	12.0	7.3	3.7	1.1	-0.7	-1.9	-2.3
-19	-5.6	-6.0	-6.5	-6.8	-7.1	-7.3	-7.4	-19	12.0	7.4	4.1	1.7	0.0	-1.0	-1.3
-16	-6.0	-6.3	-6.7	-7.0	-7.2	-7.4	-7.6	-16	12.0	7.6	4.5	2.2	0.7	-0.1	-0.3
-13	-6.2	-6.5	-6.7	-7.0	-7.2	-7.5	-7.7	-13	12.0	7.8	4.8	2.7	1.3	0.7	0.6
-10	-6.3	-6.5	-6.7	-6.9	-7.1	-7.3	-7.6	-10	12.0	8.0	5.1	3.1	1.9	1.3	1.4

Table 3-15, Comparison of the results, superheating 22.2 °C

## 4. Summary

### Return gas temp 18.3 °C

Capacity: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	-8.2	-10.5	-11.8	-11.4	-13.9	-14.9	-16.0
-37	-7.6	-10.4	-12.1	-13.3	-14.3	-15.2	-16.1
-34	-6.4	-9.6	-11.6	-12.9	-13.9	-14.8	-15.5
-31	-4.9	-8.5	-10.6	-12.1	-13.1	-13.8	-14.4
-28	-3.5	-7.2	-9.5	-11.0	-12.0	-12.7	-13.1
-25	-2.3	-6.0	-8.4	-9.9	-10.9	-11.5	-11.9
-22	-1.2	-5.0	-7.3	-8.8	-9.8	-10.3	-10.7
-19	-0.3	-4.1	-6.4	-7.9	-8.8	-9.3	-9.6
-16	0.4	-3.3	-5.6	-7.1	-7.9	-8.4	-8.6
-13	0.9	-2.8	-5.0	-6.4	-7.2	-7.6	-7.8
-10	1.1	-2.4	-4.5	-5.9	-6.6	-7.0	-7.1

EER: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	-10.8	-11.1	-10.8	-8.9	-10.3	-10.6	-11.4
-37	-8.9	-10.2	-10.6	-10.6	-10.8	-11.1	-11.8
-34	-6.3	-8.3	-9.2	-9.6	-10.0	-10.4	-11.1
-31	-3.4	-5.9	-7.3	-8.0	-8.5	-9.0	-9.7
-28	-0.5	-3.5	-5.1	-6.1	-6.8	-7.4	-8.1
-25	2.1	-1.2	-3.1	-4.3	-5.1	-5.8	-6.6
-22	4.3	0.8	-1.3	-2.6	-3.5	-4.3	-5.2
-19	6.0	2.4	0.1	-1.3	-2.3	-3.2	-4.2
-16	7.3	3.5	1.2	-0.4	-1.6	-2.6	-3.6
-13	7.9	4.1	1.7	0.0	-1.2	-2.3	-3.5
-10	8.0	4.2	1.7	0.0	-1.4	-2.6	-3.9

### Superheating 11.1 °C

Capacity: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	15.1	8.5	3.2	-1.9	-6.8	-11.5	-15.7
-37	12.8	5.5	0.1	-4.7	-9.0	-12.9	-16.2
-34	12.4	4.6	-1.0	-5.5	-9.4	-12.7	-15.4
-31	12.6	4.5	-1.1	-5.4	-8.9	-11.8	-14.0
-28	12.8	4.7	-0.8	-4.9	-8.0	-10.5	-12.3
-25	12.8	4.9	-0.4	-4.2	-7.1	-9.1	-10.6
-22	12.4	4.9	-0.1	-3.6	-6.1	-7.9	-9.0
-19	11.7	4.7	0.1	-3.1	-5.3	-6.8	-7.7
-16	10.7	4.2	0.0	-2.8	-4.7	-5.9	-6.6
-13	9.4	3.6	-0.2	-2.7	-4.3	-5.2	-5.7
-10	8.0	2.8	-0.5	-2.7	-4.0	-4.8	-5.0

EER: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	15.8	10.0	5.6	1.3	-3.0	-7.3	-11.5
-37	14.1	7.7	3.2	-0.8	-4.4	-8.0	-11.3
-34	14.6	7.7	2.9	-0.8	-4.1	-7.0	-9.7
-31	15.8	8.5	3.7	0.1	-2.8	-5.3	-7.5
-28	17.0	9.6	4.8	1.4	-1.3	-3.4	-5.3
-25	17.8	10.6	5.9	2.7	0.3	-1.6	-3.2
-22	18.3	11.2	6.8	3.7	1.5	-0.2	-1.6
-19	18.1	11.5	7.3	4.5	2.4	0.9	-0.5
-16	17.5	11.3	7.4	4.8	2.9	1.4	0.1
-13	16.4	10.8	7.1	4.7	2.9	1.5	0.1
-10	14.9	9.8	6.4	4.1	2.4	1.0	-0.4

### Superheating 22.2 °C

Capacity: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	12.7	6.3	1.1	-3.3	-7.0	-9.7	-11.2
-37	12.1	5.5	0.3	-4.0	-7.4	-9.8	-11.1
-34	10.9	4.5	-0.6	-4.6	-7.7	-9.9	-11.0
-31	9.6	3.4	-1.3	-5.1	-7.9	-9.8	-10.7
-28	8.4	2.5	-2.0	-5.4	-7.9	-9.6	-10.3
-25	7.3	1.8	-2.4	-5.5	-7.8	-9.2	-9.8
-22	6.4	1.3	-2.6	-5.5	-7.5	-8.8	-9.2
-19	5.8	0.9	-2.6	-5.3	-7.1	-8.2	-8.6
-16	5.3	0.8	-2.5	-4.9	-6.6	-7.5	-7.9
-13	5.1	0.8	-2.2	-4.5	-6.0	-6.8	-7.1
-10	4.9	1.0	-1.9	-4.0	-5.3	-6.1	-6.4

EER: DR7 change relative to R404A (%)

°C	60	55	50	45	40	35	30
-40	10.8	7.6	4.6	1.5	-1.4	-4.0	-5.9
-37	11.7	7.6	4.0	0.8	-2.1	-4.4	-6.0
-34	12.0	7.4	3.6	0.4	-2.3	-4.4	-5.8
-31	12.0	7.2	3.4	0.3	-2.3	-4.1	-5.2
-28	12.0	7.1	3.3	0.4	-1.9	-3.5	-4.4
-25	12.0	7.1	3.5	0.7	-1.4	-2.7	-3.4
-22	12.0	7.3	3.7	1.1	-0.7	-1.9	-2.3
-19	12.0	7.4	4.1	1.7	0.0	-1.0	-1.3
-16	12.0	7.6	4.5	2.2	0.7	-0.1	-0.3
-13	12.0	7.8	4.8	2.7	1.3	0.7	0.6
-10	12.0	8.0	5.1	3.1	1.9	1.3	1.4