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Using Refrigerant GWP Values –
A guide to selecting the appropriate data

Introduction

The purpose of this Fact Finder is to explain where Global Warming Potential (GWP) values for HFC refrigerants are derived from.
The first two pages of this Fact Finder explain the background for using GWP data, and the third page lists HFC refrigerants with their GWP values according to the IPPC (**I**ntergovernmental **P**anel on **C**limate **C**hange) 4th Assessment Report, which is the legal base in the EU for the new F-Gas Regulations which came into force on 1st January 2015.

Please be aware that many schemes, initiatives or reporting procedures may require the use of a value that may need to be obtained by a different source.

In all situations where you have provided outcomes using a GWP value you should state the source of the GWP value.

The GWP of a refrigerant is a calculated value of the potential of 1kg of that refrigerant to contribute to global warming if released into the atmosphere, compared to the global warming effect of 1kg of carbon dioxide, over a given time period. It provides a simple, understandable and usable number that can be used in such calculations as TEWI (**T**otal **E**nvironmental **W**arming **I**mpact) and LCCP (**L**ife-**C**ycle **C**limate **P**erformance), when designing or selecting refrigerant options.

Using valid and appropriate GWP values.

GWP is not a single definitive figure, but requires some definition based upon how it has been calculated; namely the time period (or time horizon) over which it has been determined. Time periods used in IPCC reports are 20 years, 100 year or 500 years – appropriate to the lifetime of the substance molecules in the atmosphere. Using 20 years distorts the effects of the long lifetime of carbon dioxide, whilst 500 years significantly exceeds the atmospheric effects of shorter lived HFCs. Consequently, it has been internationally agreed that the 100yr time period is the most appropriate basis, particularly for HFC Refrigerants.

Additionally, when using GWP data, it must be validated by reference to its source. Under the Kyoto Protocol and its use of GWP, IPCC has produced regular Technical Assessments, providing the best calculated GWP values based on atmospheric science knowledge prevailing at the time. With refinements in that knowledge, IPCC published GWP data has changed between Technical Assessments, so it is important when using GWP values that the appropriate IPCC Assessment Report is used and referenced (see table).

Why does the GWP of a refrigerant change?

The first significant IPCC listing of GWP values was published in 1995 – The 2nd Technical Assessment – and was used as the basis for the Kyoto Protocol. As atmospheric science has developed, the knowledge of how and by how much, carbon dioxide and other greenhouse gases contribute to atmospheric warming, has lead IPCC to publish refined GWP values in subsequent Technical Assessment Reports – 3rd Report 2000, 4th Report 2007, 5th Report 2014.

Which GWP data should be used?

Having defined the 100 year time period data as the most appropriate for HFC refrigerants, further selection of the appropriate GWP source data should be based upon the prevailing legal base and the IPCC data used by that legal based legislation. Within the EU, the F-Gas Regulation (EC) 842/2006 used the GWP values from the 3rd IPCC Technical Assessment Report published in 2000. However, the 2015 F-Gas regulation uses the 4th Assessment values. Additionally, the EU Mobile Air Conditioning (MAC) Directive (EC) 40/2006 required a maximum limit of GWP 150 on new mobile systems from 2011 onwards.

Is the use of different GWP values significant?

The change in a GWP value calculated for a refrigerant may be significantly less than the change in GWP values for specific HFC compounds between Assessment Reports, as most HFC refrigerants commonly used are blends of 2 or more substances, some, or all, of which may be HFCs. It is important that the correct GWP is used when meeting reporting obligations under the EU F-Gas Regulation, to ensure correct accounting of individual HFC compounds, but also to determine the type and frequency of leak detection that is required.

Whilst the use of a different refrigerant GWP value has very little impact on TEWI or LPPC calculations, as the most significant contribution to atmospheric warming from refrigeration or air conditioning systems comes as an indirect consequence of the energy consumption. If refrigerant selection is to be based on GWP value, those used in current legislation are preferred.

GWP Values used in 2014 F-Gas Regulation.

The GWP values used are from the IPCC 4th Assessment Report and the values stated in Annex 1 are given in Table 1 below and are the 100 year values.

Table 1

Refrigerant	GWP
HFC 23	14800
HFC 32	675
HFC 125	3500
HFC 134a	1430
HFC 143a	4470
HFC 152a	124

The GWP of refrigerant blends are shown in Table 2.

Leak Checking Requirements

The new F-Gas regulation sets leak checking requirements based upon 5, 50 and 500 CO_2 Equivalent Tonnes. The most significant changes affect high GWP refrigerants for the 500 CO_2 Equivalent Tonnes, as fixed leak detection is required for this threshold. The different requirements are shown in Table 2 for current refrigerants. The new requirements took effect from 1st January 2015, except for systems with a charge below 3kg (6kg for hermetic systems) which came into effect from 1st January 2017.

Table 2

Refrigerant	Manufacturer	Trade Name	GWP (AR4)	ASHRAE Class	5te CO_2 eq.(kg)	50te CO_2 eq.(kg)	500te CO_2 eq.(kg)
32			675	A2L	7.4	74.1	741
404A			3922	A1	1.3	12.7	127
407A			2107	A1	2.4	23.7	237
407C			1774	A1	2.8	28.2	282
407F	Honeywell	Performax LT™	1825	A1	2.7	27.4	274
407H	Daikin Chemicals		1495	A1	3.3	33.4	334
410A			2088	A1	2.4	24.0	240
417A	Chemours	ISCEON® MO59	2346	A1	2.1	21.3	213
422A	Chemours	ISCEON® MO79	3143	A1	1.6	15.9	159
422D	Chemours	ISCEON® MO29	2729	A1	1.8	18.3	183
423A	Chemours	ISCEON® 39TC™	2280	A1	2.2	21.9	219
424A	Refrigerant Solutions	RS44	2440	A1	2.0	20.5	205
426A	Refrigerant Solutions	RS24	1508	A1	3.3	33.1	331
428A	Refrigerant Solutions	RS52	3607	A1	1.4	13.9	139
434A	Refrigerant Solutions	RS45	3245	A1	1.5	15.4	154
437A	Chemours	ISCEON® MO49plus	1805	A1	2.8	27.7	277
438A	Chemours	ISCEON® MO99	2265	A1	2.2	22.1	221
442A	Refrigerant Solutions	RS50	1888	A1	2.6	26.5	265
444B	Honeywell	Solstice®L20	296	A2L	16.9	169	1690
447B	Honeywell	Solstice®L41z	740	A2L	6.8	67.6	676
448A	Honeywell	Solstice®N40	1387	A1	3.6	36.0	360
449A	Chemours	Opteon®XP40	1397	A1	3.6	35.8	358
450A	Honeywell	Solstice®N13	605	A1	8.3	82.6	826
452A	Chemours	Opteon® XP44	2140	A1	2.3	23.4	234
452B	Chemours/Honeywell	Opteon®XL55/Solstice®L41y	698	A2L	7.2	71.6	716
453A	Refrigerant Solutions	RS70	1765	A1	2.8	28.3	283
454A	Chemours	Opteon®XL40	238	A2L	21.0	210.1	2101
454B	Chemours	Opteon®XL41	466	A2L	10.7	107.3	1073
454C	Chemours	Opteon®XL20	146	A2L	34.2	342.5	3425
455A	Honeywell	Solstice®L40X	145	A2L	34.5	344.8	3448
507			3985	A1	1.3	12.5	125
508A			13214	A1	0.4	3.8	38
508B	Chemours	Suva 95	13396	A1	0.4	3.7	37
513A	Chemours	Opteon®XP10	631	A1	7.9	79.2	792
1234yf	Chemours/Honeywell	Opteon®XL10/Solstice®yf	4	A2L	1250	12500	125000
1234ze	Honeywell	Solstice®ze	6	A2L	833	8333	83333
1233zd(E)	Honeywell	Solstice®zd	4.5	A2L	1111	11111	111111