



This work is licensed under  
[Creative Commons Attribution  
4.0 International License](https://creativecommons.org/licenses/by/4.0/)

DOI: 10.53704/fujnas.v1i1.58

A publication of College of Natural and Applied Sciences, Fountain University, Osogbo, Nigeria  
Journal homepage: [www.fountainuniversity.edu.ng/journal/fujnas](http://www.fountainuniversity.edu.ng/journal/fujnas)

---

## In Search of a General IFPUG-Cosmic Conversion Method

\*Olorisade, B. K. and Lawani, A. B.

Mathematical and Computer Sciences Department, Fountain University, Osogbo, Nigeria

---

### Abstract

International Function Point User Group Function Points (IFPUG - FP) is the earliest function size estimation method; however, with the introduction of a more scientific method like the COmmon Software Measurement International Consortium Full Function Points (COSMIC - FFP) which has a wider applicability than the IFPUG, and both methods using the same measuring unit and principle, the continued relevancy of the IFPUG is called to question. In order to save organizations from losing all their investment because of migrating to using COSMIC, researchers have been trying to explore the possibility of converting the output of one method to the other. Several formulas have been proposed but none that can be generally applied yet. This paper reviews some of the popular conversion formulas that have been suggested so far, then, it used each formula to convert the IFPUG values presented in the different studies to equivalent COSMIC values. The converted COSMIC values are compared to direct measurement values to see a trend or how generalized, consistent and reliable the formulas have a tendency to or could be. It also collated IFPUG and COSMIC values of all the applications used in the different experiments plus three new ones and generated a new formula - a formula borne out of heterogeneous data. The result varied widely and nothing conclusive can be said, though, two of the formulas gave closer estimation range than others. Also, the new formula generated from the fifty eight applications gave improved results over others.

**Keywords:** IFPUG; COSMIC; project estimation

---

### Introduction

A key issue with software project is the need to quantify the project size during contract negotiation to produce an estimate for the project's cost. This estimation can be projected though the size of the software. Software size can be measured using several factors that have been discussed in the literature. Parts of these factors are:

- i. Lines of codes (LOC);
- ii. Historical data;
- iii. Function points etc.

Function points have been a means to

determine the software size since the early '70s (Desharnais *et al.*, 2006). The International Function Points User Group (IFPUG) method is the earliest and most widely used method for calculating the function size of a software project. However, different Function Point Analysis (FPA) techniques have evolved over the years (Cuadrado-Gallego *et al.*, 2008a; Cuadrado-Gallego *et al.*,

---

\*Corresponding author Tel: +2348120451374  
E-mail: [gasimbatunde@yahoo.co.uk](mailto:gasimbatunde@yahoo.co.uk)

2007; Gencel and Demirors, 2007), all aiming to correct the lapses of the IFPUG. Only four of them have matured to ISO measurement standard level -ISO 19761: COSMIC FFP (ISO, 2003a), ISO 20926: Function point analysis, e.g., IFPUG 4.1 (ISO, 2003b) though without its adjustment factor (Cuadrado-Gallego *et al.*, 2008a), ISO 20968: Mk II (ISO, 2002) and ISO 24570: NESMA (ISO, 2005).

Out of the four techniques, the COSMIC is designed to measure a wide range of application software unlike the other three that are designed to measure specific application type - mostly business application software (Mills and Shingler, 1988; Cuadrado-Gallego *et al.*, 2008a; Dekkers and Vogelezang; 2003).

Based on its wide applicability and ease of use, the COSMIC has been pitched as one measurement method to succeed the IFPUG FPA (Rabbi *et al.*, 2009; Lavazza, 2009). This fact is also supported as shown in studies that size estimation from COSMIC results in better effort and cost projection than that of the IFPUG (Vogelezang, 2005).

Organizations accustomed to the IFPUG method but also interested in COSMIC FFP have shown interest in a conversion methodology between the two. This is in order to leverage their historical IFPUG FPA data and years of investment in it (Abran *et al.*, 2011; Cuadrado-Gallego *et al.*, 2008a).

In view of this, researchers have been working on establishing possible relationship model between the IFPUG FPA and COSMIC FFP. Several models have been proposed (Fetcke, 1999; Desharnais *et al.*, 2006) (Cuadrado-Gallego *et al.*, 2008b; Cuadrado-Gallego *et al.*, 2008a; Lavazza, 2009), but most of the proposed conversion models have limitations in terms of software size they can measure or application type. Therefore, the industry is still lost as to what method to use in converting COSMIC FFP to IFPUG FP. More importantly, there is yet to be a conversion method that is generally applicable to all or a wide range of application type. The aim of this paper is to review some of the existing proposed conversion ratios (formulas) and see if any of them has the potential to emerge as unique and

application independent IFPUG - COSMIC conversion ratio. Though, this might not have been initially claimed or intended by its proponent. Also, we shall investigate what will be the characteristics of a formula that evolve from collection of varied application type and size using studies presented in the previous researches that will be reviewed.

This paper is organized as follows: a cursory look at related work is presented in Section II and approach to the study in Section III. Section IV and Section V present the detailed calculation and results of measuring the two case studies with IFPUG and COSMIC respectively. Section VI analyzes the result of the study, while conclusion and future work is the focus of Section.VII.

### Conversion Techniques Overview

Six relevant studies on conversion formulas between IFPUG and COSMIC will be presented in chronological order and approach used to generate the formula. Basically, so far, majority of the conversion ratios are proposed based on experimental studies of statistical relationship between the results of IFPUG and COSMIC calculations. Other type is theoretical approach.

### Experimental studies

The results of the experimental studies has been either a linear equation usually of the form  $A = b * C + d$  (Cuadrado-Gallego *et al.*, 2008a).....(1) where  $C$  is the Unadjusted function points as calculated or a non-linear equation. The linear equation formulas are of interest in this study.

In a study conducted by Fetcke (1999), five business applications of a data storage system were measured (Desharnais *et al.*, 2006, Fetcke, 1999). At the end of his study, a conversion formula with  $R^2 = 0.97$  was obtained:

$$Y(Cfsu) = 1.1 * (UFP) - 7.6 \dots\dots\dots(2)$$

In the study, the applications (Table 1) were measured with both IFPUG 4.1 and COSMIC FFP

Column 2 is the unadjusted function points calculated, column 3 is the calculated COSMIC FFP while column 4 is the same derived from the formula. Column 5 presents the percentage of the absolute difference between the calculated and derived COSMIC values (similar tables will follow

Table 1: Data from Fetcke measurement

ID	UFP	FFP <sub>c</sub>	FFP <sub>d</sub>	FFP <sub>d</sub> - FFP <sub>c</sub>   / FFP <sub>c</sub> %
1	77	81	77.1	4.8%
2	40	38	36.4	4.2%
3	49	51	46.3	9.2%
4	56	52	54	3.8%
5	31	29	26.5	8.6%

similar headings). It can be seen from table 1 that the percentage difference ranges from approximately 4 to 9%. The variation is not really significant but it should be noted that the sample size is small and the applications are similar.

The same year, Abran (Desharnais *et al.*, 2006) conducted a similar study and proposed:

$$Y(Cfsu) = 1.0 * (UFP) - 3 \dots\dots\dots(3)$$

the data sets from which this was generated is not available to the authors during this work.

In 2003, Vogezang, on the other hand, used the same approach on eleven projects of Rabobank initially measured with NESMA and proposed the convertibility formula (Vogezang, 2003, Vogezang and Lesterhuis, 2003) with R<sup>2</sup> = 0.99:

$$Y(Cfsu) = 1.2 * (UFP) - 87 \dots\dots\dots(4)$$

The constant was attributed to the contribution of logical files. This formula was also found to be applicable to big projects with FP ≥ 200. This can be inferred from table 2 since the percentage difference seems to hover around single digit for projects that are fairly large except for project ID 7 and 8 where significant discrepancy is noticed in the UFP and FFP<sub>c</sub>. the description of the measured applications was not explicit but it may be inferred that they are similar since they are from the Rabobank as stated in (Vogezang, 2003). The percentage difference obtained for project ID 1, 2 and 3 (Table 2) appears out of order. This may be the reason why Volgezang obtained another formula suitable to smaller projects with FP < 200:

$$Y(Cfsu) = 0.75 * (UFP) - 2.6 \dots\dots\dots(5)$$

If this formula is applied to projects in row 1 through 3 of table 2 the percentage difference obtained becomes drastically low - 16, 26 and 24 respectively.

Table 2: Data sets from Volgezang

ID	UFP	FFP <sub>c</sub>	FFP <sub>d</sub>	FFP <sub>d</sub> - FFP <sub>c</sub>   / FFP <sub>c</sub> %
1	39	23	-40	275%
2	52	29	-25	185%
3	120	115	57	50%
4	170	109	117	7%
5	218	181	175	4%
6	224	182	182	0%
7	249	173	212	22%
8	260	81	225	178%
9	380	368	369	0%
10	766	810	832	3%
11	1424	1662	1622	2%

In 2005, a new convertibility formula was suggested by (Desharnais *et al.*, 2006) using dataset from the documentation of finished projects of a governmental organization. The equation proposed was:

$$Y(Cfsu) = 0.84 * (UFP) + 18 \dots\dots\dots(6)$$

The results presented in table 3 show a wide variation between in percentage difference between the direct calculation of COSMIC FFP and the derived one.

**Theoretical Study**

In 2007, (Cuadrado-Gallego *et al.*, 2008b) proposed a theoretical formula which he also verified empirically on 33 applications. In the formula, he tried to eliminate the effect of logical files, which were identified as the source of the offsets of earlier formulas from linear

Table 3: Data set for Deshamais 2005

ID	UFP	FFP <sub>c</sub>	FFP <sub>d</sub>	FFP <sub>d</sub> - FFP <sub>c</sub>   / FFP <sub>c</sub> %
1	103	75	104.52	39%
2	362	209	322.08	54%
3	124	170	122.16	28%
4	263	203	238.92	18%
5	1146	934	980.64	5%
6	570	675	496.8	26%

regression. The formula he suggested is below:

$$\sum_{i=0}^{EL} \max(2, FTRi + 1) + \sum_{i=0}^{EO} \max(2, FTRi + 1) + \sum_{i=0}^{EQ} \max(2, FTRi + 1) \leq CFSU \leq \sum_{i=0}^{EL} \max(2, 2.FTRi + 1) + \sum_{i=0}^{EO} \max(2, 2.FTRi + 1) + \sum_{i=0}^{EQ} \max(2, 2.FTRi + 1) \dots\dots\dots(7)$$

Table 4 presents the data sets presented by (Cuadrado-Gallego *et al.*, 2008b) in their study, columns 4 and 5 are the minimum and maximum COSMIC values respectively derived from his formula while columns 6 and 7 are the respective percentage differences.

**FSU for three new systems**

The details of COSMIC 2.2 and IFPUG 4.1 process are discussed in details in (Rabbi *et al.*, 2009; Cuadrado-Gallego *et al.*, 2008b; Consortium, 2007; Gencil and Demirors, 2007; Lavazza, 2009). Three more systems are introduced in this paper to further exercise the conversion formulas under review. The IFPUG and COSMIC values for the three applications will first be manually determined (Table 5). Afterwards, all the applications used in generating the different formulas will be merged with the new ones presented in this paper and then we will calculate the outcome from each of the models considering all the applications.

The applications introduced in this work are not big applications. They are introduced to further exercise the formulas and most especially to see if the formulas can actually produce good results even in applications they were not created from.

Application 1 is a small business application while application 2 is an event-driven application taken from (Rabbi *et al.*, 2009). The IFPUG and COSMIC calculations for the two are used directly as presented in (Rabbi *et al.*, 2009). Application 3 is a bank reconciliation application, its IFPUG and COSMIC values are calculated in this work and details presented in Appendix I.

Only the positive percentage difference between the direct calculation of COSMIC and conversion is considered meaningful for this study. Thus, count in table 6 shows the number of applications with positive percentage difference for each formula. Consequently, the mean is the total number of positive percentage difference for each formula divided by count. The (Cuadrado-Gallego *et al.*, 2008b) formula is not included because there is not enough information about some of the applications to use the conversion process except for the ones he presented in his work. Fetcke (1999) produced highest positive count while (Vogelezang, 2003) formula for UFP less than 200 yielded the least count. Note that only 21 of the application have UFP less than 200. The (Abran *et al.*, 2001) and (Desharnais *et al.*, 2006) appear to produce better results than others as they have applications within the 0% - 50% percentage difference range.

**Model from pooled data**

A statistical relationship (linear) between all the fifty eight applications yielded a new formula with R<sup>2</sup> = 0.91:

$$CFP = 1.0144 (UFP) - 60.15 \dots\dots\dots(8)$$

This formula is in turn used to calculate COSMIC values for each of the applications from their FPAs. The result is shown in Appendix IV. A summary that compares this result with that of other individual formulas is shown in table 7, it is obvious from table 6 that only Desharnais and Abran equations produced a 50% percentage difference on about half of the data considered while all of them have less that 25% performance when the percentage difference is 20% or less. The model generated from the pooled data obviously displayed a better performance as shown in table 7 with more than 50% performance when the percentage difference is 25% or less and about 70% when the percentage difference is 50% or less.

Table 4: Cuadrado data set

ID	UFP	FFP <sub>c</sub>	FFP <sub>dmin</sub>	FFP <sub>dmax</sub>	FFP <sub>d</sub> - FFP <sub>c</sub>   / FFP <sub>c</sub> %	
					min	max
1	95	68	43	73	37%	7%
2	126	80	51	88	36%	10%
3	78	72	43	73	40%	1%
4	329	177	115	198	35%	12%
5	340	195	180	301	8%	54%
6	324	267	169	278	37%	4%
7	177	108	66	114	39%	6%
8	381	278	228	403	18%	45%
9	360	210	201	352	4%	68%
10	286	191	112	200	41%	5%
11	463	286	208	357	27%	25%
12	283	263	175	312	33%	19%
13	109	65	42	68	35%	5%
14	432	294	228	392	22%	33%
15	326	200	165	436	18%	118%
16	331	234	146	244	38%	4%
17	236	158	130	236	18%	49%
18	324	297	194	342	35%	15%
19	311	310	189	329	39%	6%
20	346	263	156	268	41%	2%
21	410	215	178	278	17%	29%
22	396	279	181	292	35%	5%
23	279	166	117	199	30%	20%
24	234	224	152	260	32%	16%
25	412	248	227	400	8%	61%
26	315	313	189	324	40%	4%
27	157	215	129	249	40%	16%
28	307	264	200	375	24%	42%
29	167	125	111	208	11%	66%
30	299	267	165	295	38%	10%
31	269	144	105	180	27%	25%
32	299	277	171	285	38%	3%
33	320	155	150	269	3%	74%

Table 5: FPA and FFP calculation for 3 new applications

	EI	EO	EQ	ILF	EIF	FPA	Entries:	Exits	Read	Write	FFP
Application 1	53	16	35	35	15	154	33	32	17	15	97
Application 2	16	00	09	14	07	46	06	07	01	05	19
Application 3	20	30	24	15	20	109					28

**Exercising with the models**

The result of application of each of the proposed conversion formulas on the available FPA and FFP calculation results of the pool of applications from all the experiments is presented in Appendix II. However, the descriptive summary of the process is shown in table 6.

Only the positive percentage difference between the direct calculation of COSMIC and conversion is considered meaningful for this study. Thus, count in table 6 shows the number of applications with positive percentage difference for each formula. Consequently, the mean is the total number of positive percentage difference for each formula divided by count. The (Cuadrado-Gallego *et al.*, 2008b) formula is not included because there is not enough information about some of the applications to use the conversion process except for the ones he presented in his work. Fetcke (1999) produced highest positive count while (Vogelezang, 2003) formula for UFP less than 200 yielded the least count. Note that only 21 of the application have UFP less than 200. Abran *et al.*, 2001 and Desharnais *et al.*, 2006 appear to produce better results than others as they have applications within the 0% - 50% percentage difference range.

**Model from pooled data**

A statistical relationship (linear) between all the fifty eight applications yielded a new formula with  $R^2 = 0.91$ :

$$CFP = 1.0144 (UFP) - 60.15 \dots\dots\dots (8)$$

This formula is in turn used to calculate COSMIC values for each of the applications from their FPAs. The result is shown in Appendix IV. A summary that compares this result with that of other individual formulas is shown in table 7, it is obvious from table 6 that only Desharnais and Abran equations produced a 50% percentage difference on about half of the data considered while all of them have less that 25% performance when the percentage difference is 20% or less. The model generated from the pooled data obviously displayed a better performance as shown in table 7 with more than 50% performance when the percentage difference is 25% or less and about 70% when the percentage difference is

50% or less.

**Discussion**

The results in table 6 did not reveal any strong insight into the potential of any of the formulas as to their applicability on a wide range of applications. This fact buttresses the stand of the proposers of these formulas that their application is still limited to the set and type of application from which each is generated. Also, this may account for the reason why each there has been no consistency trend in the formulas obtained by different researchers. Thus, it is advisable that organizations interested in having a conversion means between IFPUG and COSMIC should experiment with their own data and established a relation that may be applicable based on their own type of application and data. Extensive research is still required to further exercise both measurement processes to obtain an enduring, sustainable and generally applicable, application independent conversion formula between the two.

Nevertheless, the best option for the industry is to have one or some generally applicable conversion formulas for use. It is our belief that this can only become possible when the proposition of the formulas move beyond just selecting a small set or unique type of applications to propose but collecting varied large number of applications. It will then be possible to study the offset value and see how it varies or what factors contributes to its magnitude.

This we have demonstrated in this work and the formula that originated from previous works combined on similar subject exhibited a fairly improved performance in its conversion result when compared to the direct COSMIC measurement results.

**Conclusion**

This paper examined the two most widely used function size measurement methods, COSMIC and IFPUG. The main aim was to present the progress level on effort to establish a convertible relationship between the two methods and see if any of the proposed conversion formulas exhibit any tendency being application independent

Table 6: Descriptive summary result from application of the formulas

	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)
Count	50	46	32	47	29
Mean	60	52	42	53	32
Range	241	197	178	217	138
< 10%	6	6	7	8	5
<= 20%	11	12	10	11	12
<= 25%	12	13	13	14	17
<= 50%	23	28	20	25	23

Table 7: Summary comparing new formula with former ones

	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)	New Model
Count	50	46	32	47	29	51
Mean	60	52	42	53	32	46
< 10%	6	6	7	8	5	8
<= 20%	11	12	10	11	12	25
<= 25%	12	13	13	14	17	30
<= 50%	23	28	20	25	23	42

despite being created from specific and limited type of applications. Also, we intended to generate a formula out of the measurement data used in generating each of the conversion formula used in this work. We presented six conversion formulas and review their consistency by applying them on the FP results of fifty-eight projects - pooled from the different experiments that generated the formulas and three new ones introduced in this work. The result varied widely and nothing conclusive can be said, though, two of the formulas gave closer estimation range to calculated results than others. Afterwards, we generated another model based on all the research data pooled together and checked its performance against the six. It displayed relatively better performance in terms of the difference between its calculated result and direct calculation.

More research is still required to establish a unique or some convertibility relationship between IFPUG and COSMIC independent of any application and also in the creation of a cost and effort estimation tool for COSMIC users.

**References**

Abran, A., Desharnais, J. M. and Aziz, F. (2011).

Measurement convertibility—from function points to COSMIC FFP. *Cosmic Function Points: Theory and Advanced Practices* 214.

Abran, A., Symons, C., and Oligny, S. (2001) An overview of COSMIC-FFP field trial results. 2-4.

Consortium (2007). The COSMIC functional size measurement method-version 3.0 measurement manual (The COSMIC Implementation Guide for ISO/IEC 19761: 2003).

Cuadrado-Gallego, J., Rodríguez, D., Machado, F., and Abran, A. (2007). Convertibility between IFPUG and COSMIC functional size measurements. *Product-Focused Software Process Improvement* 273-283.

Cuadrado-Gallego, J. J., Buglione, L., Rejas-Muslera, R. J. and Machado-Piriz, F. (2008a). IFPUG-COSMIC statistical conversion. *Software Engineering and Advanced Applications, SEAA '08. 34th Euromicro Conference* 3-5, 427-432.

Cuadrado-Gallego, J. J., Machado-Piriz, F., and Aroba-Piez, J. (2008b). On the conversion between IFPUG and COSMIC software functional size units: A theoretical and empirical study. *Journal of Systems and*

- Software 8*; 661-672.
- Dekkers, T., and Vogezang, F. (2003). *COSMIC full function points: additional to or replacing FPA*. Citeseer.
- Desharnais, J. M., Abran, A., and Cuadrado, J. (2006). Convertibility of function points to COSMIC-FFP: Identification and analysis of functional outliers. *MENSUR A*, 190.
- Fetcke, T. (1999). The warehouse software portfolio: A case study in functional size measurement, Citeseer.
- Gencel, C. and Demirors, O. (2007). Conceptual differences among functional size measurement methods. *IEEE*, 305-313.
- ISO (2002). 20968: 2002, Software engineering - Mk II function point analysis --Counting Practices Manual. International Organization for Standardization --ISO, Geneva.
- ISO (2003a). 19761:2003, Software Engineering - COSMIC-FFP - A functional size Measurement Method. International Organization for Standardization -ISO, Geneva.
- ISO 2003b. IEC 20926: 2003, Software engineering-IFPUG 4.1 Unadjusted functional size measurement method-Counting practices manual. International Organization for Standardization, Geneva.
- ISO (2005). 24750: 2005, Software engineering - NESMA functional size measurement method version 2.1 --Definitions and counting guidelines for the application of Function Points Analysis. International Organization for Standardization --ISO, Geneva.
- Lavazza, L. (2009). Convertibility of functional size measurements: new insights and methodological issues. Proceedings of the 5th International Conference on Predictor Models in Software Engineering. Vancouver, British Columbia, Canada: ACM.
- Mills, E. E. and Shingler, K. H. (1988). *Software Metrics-SEI Curriculum Module SEI-CM-12-1.1*.
- Rabbi, M. F., Natraj, S. and Olorisade, B. K. (2009). Evaluation of Convertibility Issues between IFPUG and COSMIC Function Points. Proceedings of the 4th International Conference on Software Engineering Advances ICSEA '09, Porto, Portugal. IEEE, 277-281.
- Vogezang, F. (2005). *COSMIC Full Function Points The next generation of functional sizing*. SMEF 2005, 281.
- Vogezang, F. and Lesterhuis, A. (2003). Applicability of COSMIC Full Function Points in an administrative environment: Experiences of an early adopter. Citeseer.

APPENDIX I - FPA calculation for Bank reconciliation application

Function Type	Complexity	Total Complexity	Total
EI	0 LOW X 3	00	20
	5 AVG X 4	20	
	0 High X 6	00	
EO	0 LOW X 4	00	30
	6 AVG X 5	30	
	0 High X 7	00	
EQ	0 LOW X 3	00	24
	0 AVG X 4	00	
	4 High X 6	24	
ILF	0 LOW X 7	00	15
	0 AVG X 10	00	
	1 High X 15	15	
EIF	0 LOW X 5	00	20
	0 AVG X 7	00	
	2 High X 10	20	
Total			109 UFP

APPENDIX II - Conversion Results from each formula

UFP	FFP	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)	Cuadrado		UFP	FFP	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)	Cuadrado	
							min	max								min	max
95	68	97	98	27	92	69	43	73	299	267	321	269	272	296	222	165	295
126	80	131	124	64	123	92	51	88	269	144	288	244	236	266	199	105	180
78	72	78	84	7	75	56	43	73	299	277	321	269	272	296	222	171	285
329	177	354	294	308	326	244	115	198	320	155	344	287	297	317	237	150	269
340	195	366	304	321	337	252	180	301	103	75	106	105	37	100	75		
324	267	349	290	302	321	240	169	278	362	209	391	322	347	359	269		
177	108	187	167	125	174	130	66	114	124	170	129	122	62	121	90		
381	278	412	338	370	378	283	228	403	263	203	282	239	229	260	195		
360	210	388	320	345	357	267	201	352	1146	934	1253	981	1288	1143	857		
286	191	307	258	256	283	212	112	200	570	675	619	497	597	567	425		
463	286	502	407	469	460	345	208	357	39	23	35	51	-40	36	27		
283	263	304	256	253	280	210	175	312	52	29	50	62	-25	49	36		
109	65	112	110	44	106	79	42	68	120	115	124	119	57	117	87		
432	294	468	381	431	429	321	228	392	170	109	179	161	117	167	125		
326	200	351	292	304	323	242	165	436	218	181	232	201	175	215	161		
331	234	357	296	310	328	246	146	244	224	182	239	206	182	221	165		
236	158	252	216	196	233	174	130	236	249	173	266	227	212	246	184		
324	297	349	290	302	321	240	194	342	260	81	278	236	225	257	192		
311	310	335	279	286	308	231	189	329	380	368	410	337	369	377	282		
346	263	373	309	328	343	257	156	268	766	810	835	661	832	763	572		
410	215	443	362	405	407	305	178	278	1424	1662	1559	1214	1622	1421	1065		
396	279	428	351	388	393	294	181	292	77	81	77	83	5	74	55		
279	166	299	252	248	276	207	117	199	40	38	36	52	-39	37	27		
234	224	250	215	194	231	173	152	260	49	51	46	59	-28	46	34		
412	248	446	364	407	409	306	227	400	56	52	54	65	-20	53	39		
315	313	339	283	291	312	234	189	324	31	29	27	44	-50	28	21		
157	215	165	150	101	154	115	129	249	154	97	162	147	98	151	113	77	99
307	264	330	276	281	304	228	200	375	46	19	43	57	-32	43	32	19	25
167	125	176	158	113	164	123	111	208	109	28	112	110	44	106	79		

APPENDIX III - Percentage Difference result in Appendix II

ID	UFP	FFP	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)	ID	UFP	FFP	Fetcke	Deshamais	Volgezang	Abran	Volgezang (<200)
1	95	68	43	44	-60	35	1	30	299	267	20	1	2	11	-17
2	126	80	64	55	-20	54	15	31	269	144	100	69	64	85	38
3	78	72	9	16	-91	4	-22	32	299	277	16	-3	-2	7	-20
4	329	177	100	66	74	84	38	33	320	155	122	85	92	105	53
5	340	195	88	56	65	73	29	34	103	75	41	39	-51	33	0
6	324	267	31	9	13	20	-10	35	362	209	87	54	66	72	29
7	177	108	73	54	16	61	21	36	124	170	-24	-28	-64	-29	-47
8	381	278	48	22	33	36	2	37	263	203	39	18	13	28	-4
9	360	210	85	53	64	70	27	38	1146	934	34	5	38	22	-8
10	286	191	61	35	34	48	11	39	570	675	-8	-26	-12	-16	-37
11	463	286	75	42	64	61	21	40	39	23	53	121	-275	57	16
12	283	263	15	-3	-4	6	-20	41	52	29	71	113	-185	69	26
13	109	65	73	69	-33	63	22	42	120	115	8	3	-50	2	-24
14	432	294	59	30	47	46	9	43	170	109	65	48	7	53	15
15	326	200	76	46	52	62	21	44	218	181	28	11	-4	19	-11
16	331	234	52	27	33	40	5	45	224	182	31	13	0	21	-9
17	236	158	59	37	24	47	10	46	249	173	54	31	22	42	6
18	324	297	17	-2	2	8	-19	47	260	81	244	192	178	217	138
19	311	310	8	-10	-8	-1	-26	48	380	368	12	-8	0	2	-23
20	346	263	42	17	25	30	-2	49	766	810	3	-18	3	-6	-29
21	410	215	106	69	88	89	42	50	1424	1662	-6	-27	-2	-15	-36
22	396	279	53	26	39	41	6	51	77	81	-5	2	-93	-9	-32
23	279	166	80	52	49	66	24	52	40	38	-4	36	-203	-3	-28
24	234	224	12	-4	-13	3	-23	53	49	51	-9	16	-155	-10	-33
25	412	248	80	47	64	65	24	54	56	52	4	25	-138	2	-24
26	315	313	8	-10	-7	0	-25	55	31	29	-9	52	-272	-3	-29
27	157	215	-23	-30	-53	-28	-46	56	154	97	67	52	1	56	16
28	307	264	25	5	7	15	-14	57	46	19	126	198	-267	126	68
29	167	125	41	27	-9	31	-2	58	109	28	301	291	56	279	183

APPENDIX IV - Result of the new conversion formula

1D	UFP	FFP <sub>c</sub>	FFP <sub>d</sub>	FFP <sub>d</sub> - FFP <sub>c</sub> / FFP <sub>c</sub> %	1D	UFP	FFP <sub>c</sub>	FFP <sub>d</sub>	FFP <sub>d</sub> - FFP <sub>c</sub> / FFP <sub>c</sub> %
1	95	68	36	47	30	299	267	243	9
2	126	80	68	15	31	269	144	213	48
3	78	72	19	74	32	299	277	243	12
4	329	177	274	55	33	320	155	264	71
5	340	195	285	46	34	103	75	44	41
6	324	267	269	1	35	362	209	307	47
7	177	108	119	11	36	124	170	66	61
8	381	278	326	17	37	263	203	207	2
9	360	210	305	45	38	1146	934	1102	18
10	286	191	230	20	39	570	675	518	23
11	463	286	410	43	40	39	23	-21	190
12	283	263	227	14	41	52	29	-7	126
13	109	65	50	22	42	120	115	62	46
14	432	294	378	29	43	170	109	112	3
15	326	200	271	35	44	218	181	161	11
16	331	234	276	18	45	224	182	167	8
17	236	158	179	13	46	249	173	192	11
18	324	297	269	10	47	260	81	204	151
19	311	310	255	18	48	380	368	325	12
20	346	263	291	11	49	766	810	717	11
21	410	215	356	65	50	1424	1662	1384	17
22	396	279	342	22	51	77	81	18	78
23	279	166	223	34	52	40	38	-20	152
24	234	224	177	21	53	49	51	-10	120
25	412	248	358	44	54	56	52	-3	106
26	315	313	259	17	55	31	29	-29	199
27	157	215	99	54	56	154	97	96	1
28	307	264	251	5	57	46	19	-13	171
29	167	125	109	13	58	109	28	50	80