EQUINITI

InFocus Document

Salary Projections

Contents

1 Introduction

This document covers the Salary Projections for the Actives Module.

This document is based on V9.25 of SuperVal. Any screenshots from previous versions are not materially different. It is relevant for the Actives module only.

SuperVal has a number of different options for defining salaries for Active members. The aim of this document is to provide the user with an understanding of how these different parameters are used.

SuperVal allows you to define up to 9 different salaries. Within each salary definition, there is substantial flexibility, designed so that users can allow for different types of averaging as well as different caps and offsets. The user is also able to take account of current Final Pensionable Salary (FPS) when calculating FPS at later dates.

2 VARPRINTs

The VARPRINT (or ACCPRINT for accrued calculations) sets out in detail how the salary is projected under each of the salary projections coded for a particular member (or members).

The VARPRINT/ACCRPINT is obtained by:

- When setting up the data file to be used adding a star in the last column for the member you wish to review.

- When setting up a Valuation Batch select either "Limited" or "Full" for the Test Valuation Run field. Selecting Limited will produce an individual member print with data for every fifth age between Valuation Date and Normal Retirement Date. Selecting Full will produce an individual member print with data for every age between Valuation Date and Normal Retirement Date.

The VARPRINT can be opened in either Excel or HTML and the section which shows the salary projections in section 2n where n is the salary number. Below is an illustration of the output for salaries 1 & 2.

21 SALARY DEFINITION 1				
21	Salary at VDATE	Salary at LDATE	Average Salary at VDATE	Average Salary at LDATE
60	20000	20500	20000	20500
61	21000	21525	21000	21525
62	22050	22601.25	22050	22601.25
63	23152.5	23731.31	23152.5	23731.31
64	24310.13	24917.88	24310.13	24917.88
65	25525.63	25525.63	25525.63	25525.63
22 SALARY DEFINITION 2				
22	Salary at VDATE	Salary at LDATE	Average Salary at VDATE	Average Salary at LDATE
60	20000	20500	19523.81	20000
61	21000	21525	20500	21000
62	22050	22601.25	21525	22050
63	23152.5	23731.31	22601.25	23152.5
64	24310.13	24917.88	23731.31	24310.13
65	25525.63	25525.63	24917.88	24917.88

The first two columns show projected salaries at each age without any averaging. "LDATE" is mid-year, except for year of retirement, where it is averaged over the same period as the VDATE figure. See Appendix for worked examples.

3 Averaging Period Options

3.1 Explanation and examples of Calculations of FPS and NRD

All the examples in this section are based on a 1 year averaging period. There are examples of longer averaging periods in section 4.

Below is a screen shot showing the salary definition screen:

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Initial Salary

Enter details of the current salary.

Override Salary Increase Rate

The user can enter an override for the main salary increase rate entered on the Financial Tab. This will only apply to this salary definition.

Promotional Scale

The user can enter a promotional scale that will be applied in addition to the main salary increase rate.

This can either be an age related Promotional Scale (Sxxx table) or a Service Related Promotional Scale (STxxx table). The Service Related Promotional Scale is only available to GAD Users.

Timing of Salary Increase and Review Date

SuperVal gives you three options for averaging. These are:

- Weighted Average

  This works out the Final Pensionable Salary over the relevant period up to the VDATE anniversary nearest NRD, taking account of the review date specified. The user will be required to enter a Review Date.

- Review Date

  This will average salary over the number of review dates specified, with the last salary used being the one on the review date before the actual NRD.

- Continuous

  This is like weighted, i.e. it works out Final Pensionable Salary over the averaging period ending on the VDATE anniversary nearest NRD, but it ignores the review date. Instead it uses the averaging period given and then adjusts by $[(1+0.5S)/ (1+S)]$. (Unless averaging period is zero, in which case no averaging is applied).

Averaging Period

Enter the averaging period that SuperVal should use. Note this should be in whole years.

Averaging ceases on

Select from either the point of exit or Normal Retirement Date.

Include the Last Salary in the Averaging Period?

If "unchecked" then SuperVal will add 2 years to the averaging period above. If "checked" then the salary is averaged only over the period specified.

For example, checked and a 5-year averaging period is the same as unchecked and a 3-year averaging period. (They would both result in a salary being on average 2.5 years ago.)

Salary Deductions

Enter a Deduction Initial Value, any adjustment factor and/or a Global Parameter that contains the rate of increase for the Deduction.

Salary Maximum

Enter a Maximum Initial Value, any adjustment factor and/or a Global Parameter that contains the rate of increase for the Maximum.

3.2 Worked Example of Calculation of FPS and NRD

The next page shows how Final Pensionable Salary (FPS) is calculated for each of salaries shown below. The calculations have been shown for two members, who are identical except for their Date of Birth. They have been set so that the Valuation Date anniversary closest to NRD is the one AFTER NRD for member 1 and the one BEFORE NRD for member 2.

Relevant details are:

Description	Member 1	Member 2
Salary Escalation	5%	
VDATE	01/04/2006	
Salary at VDATE	£10,000	
Review Date	1 August	
Salary over year ending 01/08/2018	$10,000 * 1.05^{12}$ =£17,958	
Salary over year ending 01/08/2019	$10,000 * 1.05^{13}$ =£18,856	
Salary over year ending 01/08/2020	$10,000 * 1.05^{14}$ =£19,799	
NRD	1 December 2019	28 September 2019

FPS calcs - worked example

Example 1

Salesc	1.05
sal0	10,000
VDATE	01/04/2006
NRD	01/12/2019
Review date	01-Aug

Timeline dates: 01/04/2018, 01/06/2018, 01/08/2018, 01/10/2018, 01/12/2018, 01/02/2019, 01/04/2019, 01/06/2019, 01/08/2019, 01/10/2019, 01/12/2019, 01/02/2020, 01/04/2020, 01/06/2020, 01/08/2020

VDATE + 12 | VDATE + 13 | VDATE + 14
NRD-1 | NRD
18,856 | 19,799
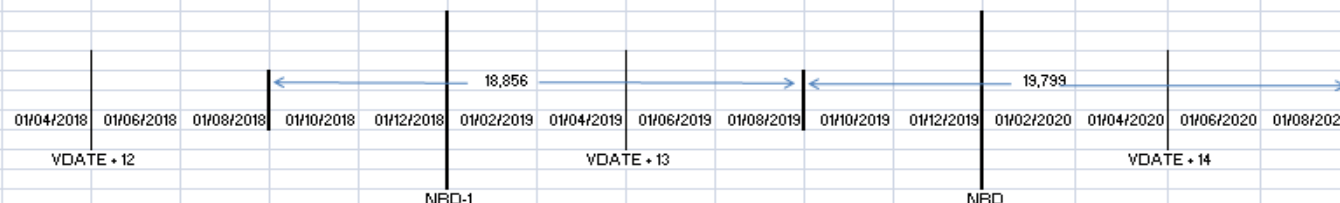
A1 - weighted increases, 1 yr average
VDATE nearest to NRD is VDATE +14, so FPS is sal over year to VDATE+14
= 18,856*4/12 + 19,799 * 8/12
A1 = 19,485

B1 - Continuous 0 yr average
VDATE nearest to NRD is VDATE +14, so FPS is sal at VDATE+14
B1 = 19,799

C1- Continuous 1 yr average
VDATE nearest to NRD is VDATE +14, so FPS is sal over year to VDATE+14, ignoring review date
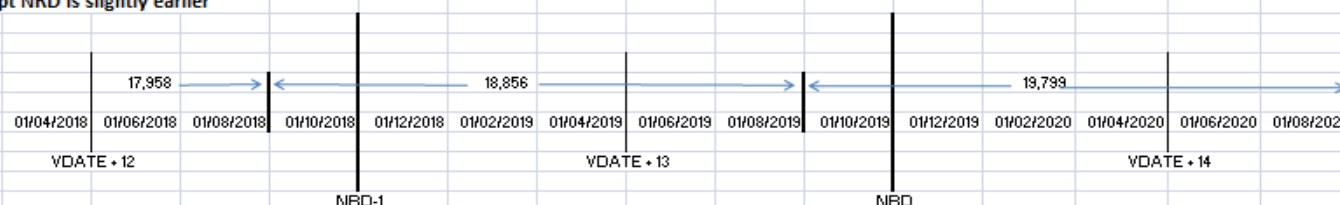=19,799 * (1.025/1.05)
C1 = 19,328

D1 - Review date, 1 yr average (and 0 yr average)
FPS is just sal at review date prior to NRD
D1 = 19,799

Example 2 - exactly the same as Eg1, except NRD is slightly earlier

Salesc	1.05
sal0	10,000
VDATE	01/04/2006
NRD	28/09/2019
Review date	01-Aug

Timeline dates: 01/04/2018, 01/06/2018, 01/08/2018, 01/10/2018, 01/12/2018, 01/02/2019, 01/04/2019, 01/06/2019, 01/08/2019, 01/10/2019, 01/12/2019, 01/02/2020, 01/04/2020, 01/06/2020, 01/08/2020

17,958 | 18,856 | 19,799
VDATE + 12 | VDATE + 13 | VDATE + 14
NRD-1 | NRD

A2 - weighted increases, 1 yr average
A2 = 18,557
VDATE nearest to NRD is VDATE +13, so FPS is sal over year to VDATE+13
= 17,958*4/12 + 18,856 * 8/12

B2 - Continuous 0 yr average
VDATE nearest to NRD is VDATE +13, so FPS is sal at VDATE+13
B2 = 18,856

C2 - Continuous 1 yr average
C2 = 18,408
VDATE nearest to NRD is VDATE +13, so FPS is sal over year to VDATE+13, ignoring review date
=18,856* (1.025/1.05)

D2 - Review date, 1 yr average (and 0 yr average)
FPS is just sal at review date prior to NRD
D2 = 19,799

3.3 Using the "Initial Final Average Salary" field

If a member is due to leave or retire from the scheme soon after the valuation date then in order to calculate Final Pensionable Salary (FPS), SuperVal will need to know what a member's salary was in the year(s) before VDATE

3.3.1   For Example

- Member Aged 65 = NRA

- Salary at VDATE = £10,000

- FPS is based on a three year average (Review Date)

- Salary Escalation is 5%

In this case, SuperVal will calculate Final Pensionable Salary at retirement as:

$$= [£10{,}000 + £10{,}000/1.05 + £10{,}000/(1.05)^2] / 3$$

$$= £9{,}531.$$

SuperVal effectively rolls back the current salary using the escalation rate provided to determine Final Pensionable Salary.

There will be some instances where the user assumes a high proportion of members leaving or retiring close to the VDATE (in particular for discontinuance and PPF Valuations), and to cater for this, SuperVal allows you to specify what the actual FPS at VDATE is. The data item is specified in the "Initial Final Average Salary" field.

If present, this data item will override the Source Data Item for PPF and discontinuance runs (i.e. when date of exit from the Scheme = VDATE). For exit dates after VDATE, SuperVal will blend the two data items as appropriate.

3.3.2   For Example

- FPS at VDATE = £30,000

- Current Salary = £40,000

- FPS is based on 3 year average

Ignoring increases, FPS for a member due to retire on VDATE will just be £30,000

FPS for a member due to retire in 1 year will be (£30,000 + £30,000 + £40,000) / 3 = £33,333.33

FPS for a member due to retire in 2 years will be (£30,000 + £40,000 + £40,000) / 3 = £36,667.67

FPS for a member due to retire in 3 years will be (£40,000 + £40,000 + £40,000) / 3 = £40,000

3.4 Promotional Salary Scale

Each salary definition in SuperVal allows you to specify a Promotional Salary Scale for both Males & Females. This is an age-related scale, which may be used for example to allow for salaries to increase at a higher rate for younger members.

One important note is that SuperVal will use the member's age nearest VDATE in order to determine which factor to use for the first salary increase after VDATE. This is illustrated below:

Say scale is:

Age	Salary Scale
57	-0.10
58	-0.05
59	0.05
60	0.10

Using the following data

Description	Member 1
VDATE	1 April 2006
Review Date	31 December
Averaging Period	1 year (Review Date)
Salary	£10,000
Salary Increase Rate	5%
NRA	60

Member 1

DOB = 01/01/1948; so age at VDATE = 58.00 (age nearest 58)

FPS = Salary at review date prior to NRD = 31/12/2007

= £10,000 x 1.05^2 x $(1 + SF_{58})$ x $(1 + SF_{59})$ = £10,997

=£10,000 x 1.05^2 x (0.95) x (1.05)

= £10,997

Member 2

DOB = 29/09/1948; so age at VDATE = 58.48 (age nearest 58)

FPS = Salary at review date prior to NRD = 31/12/2007

= £10,000 x 1.05 x $(1 + SF_{58})$ x $(1 + SF_{59})$ = £10,997

The user should note that SuperVal uses the Promotional Scale at age 58 for the increase due on 31 December 2006 despite the fact that the member is actually over 59 on that date.

4 Offset and Capping Options

For each salary that is defined, SuperVal allows you to specify either a deduction and/or a maximum amount.

If no increase rate is entered then the Maximum and the Deduction will be increased in line with the salary increase rate entered in the Override Salary Increase Rate specified above or the value entered for the Salary Increase Rate on the Financial Assumptions tab if this is blank.

4.1 Order of the Maximum and the Deduction

The User should note that

- the Maximum will always be applied before the deduction.

- "Averaging Period" and "Review Date/ Continuous/ Weighted" apply when calculating the maximum

- "Averaging Period" and "Review Date/ Continuous/ Weighted" also apply when calculating the deduction

- The Maximum is applied by comparing FPS based on "Maximum Amount" with FPS based on "Source data item" i.e. you do NOT compare each year's salary to the maximum and take the greater of the two.

The above points are illustrated by the worked example set out below. This starts off with one of the definitions used in the earlier example, and then looks at various combinations of averaging period, deduction and maximum.

4.2 Worked Example showing how Deduction and Maximum are applied

Calculate FPS at NRD for each of the salary definitions given below for a member with the following details:

- VDATE = 1 April 2006

- NRD = 1 December 2019

- SAL0 = £10,000

- Assume Salary escalation of 5% p.a.

Salary Projection Information	Salary1	Salary2	Salary3	Salary4	Salary5	Salary6
Initial Salary	Current Salary (Data)	Current Salary (Data)	Current Salary (Data)	Current Salary (Data)	Current Salary (Data)	Current Salary (Data)
Override Salary Increase Rate						
Averaging Period	1	3	3	1	1	1
Averaging Ceases	On Leaving Service	On Leaving Service	On Leaving Service	On Leaving Service	On Leaving Service	On Leaving Service
Timing of Salary Increases	Weighted	Weighted	Weighted	Weighted	Weighted	Weighted
Review Date	01/08	01/08	01/08	01/08	01/08	01/08
Include Last Salary in Average	Yes	Yes	Yes	Yes	Yes	Yes
Adjustment Factor	n/a	n/a	n/a	n/a	n/a	n/a
Deduction Initial Value			5,000		5,000	0
Deduction Increase Rate	n/a	n/a	5%	n/a	5%	n/a
Deduction Adjustment Factor	1.0	1.0	1.0	1.0	1.0	1.0
Maximum Initial Value				19,000	19,000	£5,000
Maximum Increase Rate				0%	0%	5%
Maximum Adjustment Factor	1.0	1.0	1.0	1.0	1.0	1.0

Solution

	Member 1
Sal0	10,000
Sal1	10,500
....	....
Sal11	17,103
Sal12	17,959
Sal13	18,856
Sal14	19,799

- **FPS1** = 8/12 x Sal14 + 4/12 x Sal13   =19,485

- **FPS2** = {8/12 x Sal14 + Sal13 + Sal12 + 4/12 x Sal11} / 3   =18,572

- **FPS3** = Half of FPS2   =9,286

  The Deduction is half of the basic salary and has the same increase rate. The fact that FPS3 is half of FPS2 shows that the 3-year averaging period is applied to the deduction as well as the basic salary.

- **FPS4** = Maximum Salary   =19,000

  SuperVal does NOT compare maximum with each year's salary when calculating FPS.

  So FPS4 ≠ 8/12 x min (8856, 19000) + 4/12 x min (19,799, 19000) = £18,904

  Instead, it compared FPS based on basic salary with the FPS based on the maximum amount.

  So FPS4 = Min (19485, 19000)

- **FPS5** = FPS4 – FPS1/2   =9,257

  Shows that the Maximum is applied BEFORE the deductor

  FPS6 = FPS1/2   =9,742

  Shows that the averaging period is also applied to the maximum

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5 Algebra and Worked Examples showing how all Salaries are projected in the VARPRINT

5.1 Notation

N	Is the averaging period
J	Is the rate of salary increase
FAF	Is the Final Averaging Factor over n years:

$$\text{Review date increases} = \frac{\ddot{a}^j_{\overline{n}|}}{n}$$

$$\text{Continuous increases} = \frac{(1+1/2j)_{\overline{n}|}\ddot{a}^j_{\overline{n}|}}{(1+j)\quad n} \quad (*)$$

S	Is the pensionable salary at valuation date
T	Under review date increases is the number of review date anniversaries from the valuation date to NRD. For the continuous increases case t is the number of years from the valuation date to the anniversary of the valuation date nearest the NRD
$S_x(C)$	is the salary figure at age x under column C

Note: when n=0 the FAF=1

(*) The formula for the continuous increases FAF comes from the following:

$$\frac{1}{2}\left[\frac{1}{n}\left(1 + \frac{1}{(1+j)} + \ldots + \frac{1}{(1+j)^{n-1}}\right) + \frac{1}{n}\left(\frac{1}{(1+j)} + \frac{1}{(1+j)^2} + \ldots + \frac{1}{(1+j)^n}\right)\right]$$

5.2 Review Date Increases

The salary projections, as they appear in VARPRINT are as follows:

Age	Salary at VDATE (A)	Salary at LDATE (B)	Average Salary at VDATE (C)	Average Salary at LDATE (D)
X	S	$S[1 + a.j]$	$S.\ FAF$	$S_x(C).\ [1+ a.j]$
x + 1	$S(1 + j)$	$S(1 + j)\ [1 + a.j]$	$S(1 + j)\ FAF$	$S_{x+1}(C).\ [1 + a.j]$
x + 2	$S(1 + j)^2$	$S(1 + j)^2\ [1 + a.j]$	$S(1 + j)^2.\ FAF$	$S_{x+2}(C).\ [1 + a.j]$
....	....	....	....	....
NRA	$S(1 + j)^t$	$S(1 + j)^t$	$S(1 + j)^t.\ FAF$	$S_{NRA}(C)$

a is the proportion of a year, working in days, to represent the time between the review date and the valuation date (or its next anniversary). If the review date and the valuation date coincide then $a = 0$

5.3 Continuous Increases

The salary projections, as they appear in VARPRINT are as follows:

Age	Salary at VDATE (A)	Salary at LDATE (B)	Average Salary at VDATE (C)	Average Salary at LDATE (D)
x	S	$S(1 + \tfrac{1}{2}j)$	$S.FAF$	$S_x(C)(1 + \tfrac{1}{2}j)$
x + 1	$S(1 + j)$	$S(1 + j)(1 + \tfrac{1}{2}j)$	$S(1 + j)\ FAF$	$S_{x+1}(C)(1 + \tfrac{1}{2}j)$
x + 2	$S(1 + j)^2$	$S(1 + j)^2(1 + \tfrac{1}{2}j)$	$S(1 + j)^2.\ FAF$	$S_{x+2}(C)(1 + \tfrac{1}{2}j)$
....	....	....	....	....
NRA	$S(1 + j)^t$	$S(1 + j)^t$	$S(1 + j)^t.\ FAF$	$S_{NRA}(C)$

5.4 Weighted Review Increases

The salary projections, as they appear in VARPRINT are as follows:

Age	Salary at VDATE (A)	Salary at LDATE (B)	Average Salary at VDATE (C)	Average Salary at LDATE (D)
x	S	$S[1+ a \times j]$	$S.FAF.[1+a \times j] \div (1 + j)$	$S_x(C) \times (1 + \tfrac{1}{2}j)$
x+1	$S(1 + j)$	$S(1 + j)[1+ a \times j]$	$S.FAF.[1+a \times j]$	$S_{x+1}(C) \times (1 + \tfrac{1}{2}j)$
x+2	$S(1 + j)^2$	$S(1 + j)^2[1+a \times j]$	$S(1 + j).FAF.[1+a \times j]$	$S_{x+2}(C) \times (1 + \tfrac{1}{2}j)$
…..	…..	…..	…..	…..
NRA	$S(1 + j)^t$	$S(1 + j)^t$	$S(1 + j)^{t-1}.FAF.[1+a \times j]$	$S_{NRA}(C)$

5.5 Final Average Salary Data Source

This field works in conjunction with any of the three salary increase methods.

SuperVal will take the current salary data item, the accurate final average data item and calculate the projected final average salary as follows.

z	Averaging period applicable
fasn	Final average salary calculated from current salary at time n
FASO	Accurate final average salary at the valuation date
FASn	Final average salary used in SuperVal
FASn	$= fasn + (FASO - faso).(z-n)/z$

The final tern $(z-n)/z$ has a minimum value of zero.

For example, say that:

- Current salary is £10,000
- FAS data source is £30,000
- Salary escalation = 5% pa
- 3 year average period
- Member is one year from retirement

Step 1: Calculate Average salary at VDATE and retirement, based on current salary alone:

VDATE: $1/3 \times (10{,}000 + 10{,}000/1.05 + 10{,}000/1.05^2) = £9{,}351.37$

Retirement: $1/3 \times (10{,}000 \times 1.05 + 10{,}000 + 10{,}000/1.05) = £10{,}007.94$

Step 2: Calculate excess of actual Final Average Salary over the estimated figure as a VDATE:

£30,000 - £9,351.37 = £20,468.63

Step 3: Spread this amount over the averaging period and add it on to the original figure:

Final Av sal at ret = £10,007.94 + 20,468.63 x 2/3 = £23,653.69

Using the notation from the top of this page:

fasn = £10,007.94

FASO = £30,000

Faso = £9,351.37

z = 3 and n = 1

6 Appendix – Examples

Data	Value
DOB	1 December 1959
NRD	1 December 2019
Salary at the VDATE (SAL0)	£10,000
Definition of Final Pensionable Salary	Average of last 3 years
VDATE	1 April 2006
Salary Increase Rate	5%

6.1 Review Date Increases

Suppose that the review date is 01 August each year.

Then the VARPRINT will show the projection of the salary as follows:

Age	Salary at VDATE (A)	Salary at LDATE (B)	Average Salary at VDATE (C)	Average Salary at LDATE (D)
46	10,000	10,333	9,531	9,849
47	10,500	10,850	10,008	10,341
48	11,025	11,392	10,508	10,858
.....	……….	……….	……….	……….
60	19,799	19,799	18,871	18,871

The calculated items under notation required here are as follows:

a = 243 ÷ 365= 0.665753 (243 days from review to anniversary of VDATE)

FAF= $\ddot{a}^{5\%}_{3}$ / 3 = 0.953137

Examples of some of the calculations above:

A (at 47) 10,500= 10,000 × 1.05

B (at 47) 10,850= 10,000 × 1.05 × (1 + 0.665753 × 0.05)

C (at 47) 10,008= 10,000 × 1.05 × 0.953137

D (at 47) 10,341= 10,000 × 1.05 × 0.953137 × (1+ 0.665753 × 0.05)

D (at 60) 18,871= 10,000 x 1.05^{14} x 0.953137

Column D would be used for the calculation of the benefit amounts.

6.2 Continuous Increases

If continuous salary increases are allows for then the project becomes as follows:

Age	Salary at VDATE (A)	Salary at LDATE (B)	Average Salary at VDATE (C)	Average Salary at LDATE (D)
46	10,000	10,250	9,304	9,531
47	10,500	10,763	9,770	10,008
48	11,025	11,301	10,258	10,508
…..	……….	……….	……….	……….
60	19,799	19,799	18,422	18,422

The calculated items under notation required here are as follows:

FAF = 1.025 ÷ 1.05 × 0.953137 (FAF for review date increases) = 0.930443

Examples of some of the calculations above:

A (at 47) 10,500 = 10,000 × 1.05

B (at 47) 10,763 = 10,000 × 1.05 × 1.025

C (at 47) 9,770 = 10,000 × 1.05 × 0.930443

D (at 47) 10,008 = 10,000 × 1.05 × 0.930443 × (1.05 ÷ 1.025)

 D (at 60) 18,422 = 10,000 x 1.05^{14} x 0.930443

Column D would be used for the calculation of the benefit amount.