

[back to the index](#)

## Updated report on "Standard Configurations for Unsteady Flow Through Vibrating Axial-Flow Turbomachine-Cascades"

Status as of July 1991

Compiled by T. H. Fransson and J. M. Verdon

### Appendix A2: Key to read the input files for the plot program "AEROEL"

CONTENTS:

- [1 Different Representation Possibilities](#)
- [2 Input Values for the Plot Program "AEROEL"](#)
  - [2.1 Information in the Beginning of all Files](#)
  - [2.2 PLOT-TYPES 1, 8 and 9](#)
  - [2.3 PLOT-TYPE 2](#)
  - [2.4 PLOT-TYPE 3](#)
  - [2.5 PLOT-TYPES 4, 5, 6 and 10](#)
  - [2.6 PLOT-TYPE 7](#)

#### 1 Different Representation Possibilities

[back to the top](#)

The plot program used for the Standard Configurations can give 10 different representations for each standard configuration, namely:

- Type 1: Steady-state pressure distribution along blade chord ( ).
- Type 2: Time-dependent pressure coefficient amplitude and phase angle distribution along blade chord ( ).
- Type 3: Time-dependent pressure difference coefficient amplitude and phase angle distribution along blade chord ( ).
- Type 4: Time-dependent lift coefficient amplitude and phase angle distribution along any chosen parameter ( ).
- Type 5: Time-dependent force coefficient amplitude and phase angle distribution along any chosen parameter ( ).
- Type 6: Time-dependent moment coefficient amplitude and phase angle distribution along any chosen parameter ( ).
- Type 7: Time-dependent aerodynamic damping coefficient along any chosen parameter ( ).
- Type 8: Time-dependent local aerodynamic damping coefficient amplitude and phase angle distribution along blade chord ( ).
- Type 9: Steady-state isentropic Mach number distribution along blade chord ( ).
- Type 10: Time-dependent drag coefficient amplitude and phase angle distribution along any chosen parameter ( ).

#### 2 Input Values for the Plot Program "AEROEL"

[back to the top](#)

##### 2.1 Information in the Beginning of all Files

[back to the top](#)

It should be pointed out that the file is formatted, so the exact position of all the information is important. Integers must thus be positioned as justified to the right.

**Line 1:** General information

- Columns 1-5: ISTCON = Standard Configuration number

- Columns 6-10: NEWOLD = 0 for old nomenclature (< 1.1. 1985) = 1 for new nomenclature (>1.1. 1986)

## Line 2: Types and quantity of plots desired.

- Columns 1-5: N1 = Number of plots of type 1 ( ).
- Columns 6-10: N2 = Number of plots of type 2 ( ).
- Columns 11-15: N3 = Number of plots of type 3 ( ).
- Columns 16-20: N4 = Number of plots of type 4 ( ).
- Columns 21-25: N5 = Number of plots of type 5 ( ).
- Columns 26-30: N6 = Number of plots of type 6 ( ).
- Columns 31-35: N7 = Number of plots of type 7 ( ).
- Columns 36-40: N8 = Number of plots of type 8 ( ).
- Columns 41-45: N9 = Number of plots of type 9 ( ).
- Columns 46-50: N10 = Number of plots of type 10 ( ).

Note that in the following all plots of a certain type must follow each other, and that it is not possible to mix plots of different types.

## 2.2 Plot-types 1, 8 and 9

[back to the top](#)

### Lines 3-5: General information

- Columns 1-60: Text to identify the plot.
- Columns 61-65 on line 3: HUS = Upper blade surface thickness. Only for standard configuration 9 and plot type 1.
- Columns 66-70 on line 3: HLS = Lower blade surface thickness. Only for standard configuration 9 and plot type 1.

### Line 6: Scales on y-axis

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value

### Line 7:

- Columns 1-5: NPLOT = Number of experimental cp data on the upper blade surface. NPLOT\_20.

### Lines 8-8a: Experimental data on the blade upper surface

- Columns 1-10: x(1) = x-value of first experimental data
- Columns 11-20: cp(1) = Experimental data in first point
- Columns 21-30: x(2) = x-value of 2nd experimental data
- Columns 31-40: cp(2) = Experimental data in second point
- Columns 41-50: x(3) = x-value of 3rd experimental data
- Columns 51-60: cp(3) = Experimental data in third point
- Columns 61-70: x(4) = x-value of 4th experimental data
- Columns 71-80: cp(4) = Experimental data in fourth point -> This line is repeated until all NPLOT values are given.

### Line 9:

- Columns 1-5: NPLLOT = Number of experimental cp data on the lower blade surface. NPLLOT\_20.

**Lines 10-10a:** Idem lines 8-8a, but on the blade lower surface.

**Line 11:** Indication about prediction model or end of results.

- Columns 1-5: -> "0" if no more results are to be plotted -> Number of prediction model used (for definition, see Bölcs and Fransson [1986, pp. 41-42])
- Columns 6-10: LTYPE = Identification of the line type to be plotted for this prediction model.
- Columns 11-15: NLOT = Number of calculated data that follows.

**Lines 12-12a:** Results from prediction model in the same format as the data apart from the fact that it is assumed that the prediction models use the same number of points on each blade surface. The upper surface results are first given, and thereafter the lower surface results.

- Columns 1-80: Identical to lines 8-8a.

-> RETURN TO LINE 11!

**Line 13:** Indication about parameters to be written on the plot.

- Columns 1-5: NVAL = Number of parameters to be written in the list to the right on the plots. NVAL must be `_40`.

**Lines 14-14a:** Indication about values of the parameters on the plot.

- Columns 1-5: K = Number of first parameter (see below).
- Columns 6-10: VAL(K) = Value and dimension of first parameter.
- Columns 11-15: K = Number of 2nd parameter.
- Columns 16-20: VAL(K) = Value and dimension of 2nd parameter.
- Columns 21-25: K = Number of 3rd parameter (see below).
- Columns 26-30: VAL(K) = Value and dimension of 3rd parameter.
- Columns 31-35: K = Number of 4th parameter.
- Columns 36-40: VAL(K) = Value and dimension of 4th parameter.
- Columns 41-45: K = Number of 5th parameter (see below).
- Columns 46-50: VAL(K) = Value and dimension of 5th parameter.
- Columns 51-55: K = Number of 6th parameter.
- Columns 56-60: VAL(K) = Value and dimension of 6th parameter.
- Columns 1-60 on following lines: Continuation of the rest of the NVAL parameters.

1: c	2: t	3: g	4: xa	5: ya	6: M1	7: b1	8: i
9: M2	10: b2	11: hx	12: hy	13: a	14: w	15: k	16: d
17: s	18:	19:	20:	21:	22:	23:	24:
25:	26:	27:	28: s	29:	30:	31: x	32:
33:	34: d						

Table A2.1: Key to list of parameters on each plot.

Return to line 3 and repeat the information for a total of N1, N8 or N9 times.

### 2.3 Plot-type 2

[back to the top](#)

**Lines 3-5:** General information

- Columns 1-60: Text to identify the plot.

**Line 6:**

- Columns 1-5: NPLOT = Number of experimental cp data on the upper blade surface. NPLOT\_20.

**Lines 7-7a:** Experimental data on the blade upper surface For all standard configurations apart from number 4:

- Columns 1-10:  $x(1)$  = x-value of first experimental data
- Columns 11-20:  $cp(1)$  = Amplitude of experimental data in first point
- Columns 21-30:  $fp(1)$  = Phase angle of experimental data in first point
- Columns 31-40:  $x(2)$  = x-value of experimental data in second point
- Columns 41-50:  $cp(2)$  = Amplitude of experimental data in 2nd point
- Columns 51-60:  $fp(2)$  = Phase angle of experimental data in 2nd point

-> This line is repeated until all NPLOT values are given.

For standard configuration 4:

- Columns 1-10:  $x(1)$  = x-value of first experimental data
- Columns 11-20:  $cp(1)$  = Amplitude of experimental data in first point
- Columns 21-30:  $fp(1)$  = Phase angle of experimental data in first point
- Columns 31-40:  $cp(1)$ -conf.int = 95% confidence interval of  $cp(1)$
- Columns 41-50:  $fp(1)$ -conf.int = 95% confidence interval of  $fp(1)$

-> This line is repeated until all NPLOT values are given.

**Line 8:**

- Columns 1-5: NPLOT = Number of experimental cp data on the lower blade surface. NPLOT\_20.

**Lines 9-9a:** Idem lines 7-7a, but on the blade lower surface.

**Line 10:** Scales on y-axis

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value

**Line 11:** Indication about prediction model or end of results.

- Columns 1-5: -> "0" if no more results are to be plotted -> Number of prediction model used (for definition, see Bölcs and Fransson [1986, pp. 41-42])
- Columns 6-10: LTYPE = Identification of the line type to be plotted for this prediction model.
- Columns 11-15: NPLLOT = Number of calculated data that follows.

**Lines 12-12a:** Results from prediction model in the same format as the data apart from the fact that it is assumed that the prediction models use the same number of points on each blade surface. The upper surface results are first given, and thereafter the lower surface results.

- Columns 1-80: Identical to lines 7-7a.

-> RETURN TO LINE 11!

**Line 13:** Indication about parameters to be written on the plot.

- Columns 1-5: NVAL = Number of parameters to be written in the list to the right on the plots. NVAL must be \_40.

**Lines 14-14a:** Indication about values of the parameters on the plot.

- Columns 1-5: K = Number of first parameter (see below).
- Columns 6-10: VAL(K) = Value and dimension of first parameter.
- Columns 11-15: K = Number of 2nd parameter.
- Columns 16-20: VAL(K) = Value and dimension of 2nd parameter.
- Columns 21-25: K = Number of 3rd parameter (see below).
- Columns 26-30: VAL(K) = Value and dimension of 3rd parameter.
- Columns 31-35: K = Number of 4th parameter.
- Columns 36-40: VAL(K) = Value and dimension of 4th parameter.
- Columns 41-45: K = Number of 5th parameter (see below).
- Columns 46-50: VAL(K) = Value and dimension of 5th parameter.
- Columns 51-55: K = Number of 6th parameter.
- Columns 56-60: VAL(K) = Value and dimension of 6th parameter.
- Columns 1-60 on following lines: Continuation of the rest of the NVAL parameters.
- For key to list of parameters on each plot, see table A2.1:

Return to line 3 and repeat the information for a total of N2 times.

## 2.4 Plot-type 3

[back to the top](#)

**Lines 3-5:** General information

- Columns 1-60: Text to identify the plot.

**Line 6:**

- Columns 1-5: NPLOT = Number of experimental Dcp data on the blade surface. NPLOT\_20.

**Lines 7-7a:** Experimental data on the blade surface

- Columns 1-10: x(1) = x-value of first experimental data
- Columns 11-20: Dcp(1) = Amplitude of experimental data in first point
- Columns 21-30: fDp(1) = Phase angle of experimental data in first point
- Columns 31-40: x(2) = x-value of experimental data in second point
- Columns 41-50: Dcp(2) = Amplitude of experimental data in 2nd point
- Columns 51-60: fDp(1) = Phase angle of experimental data in 2nd point -> This line is repeated until all NPLOT values are given.

**Line 8:** Scales on y-axis

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value

**Line 9:** Indication about prediction model or end of results.

- Columns 1-5: -> "0" if no more results are to be plotted -> Number of prediction model used (for definition, see Bölcs and Fransson [1986, pp. 41-42])
- Columns 6-10: LTYPE = Identification of the line type to be plotted for this prediction model.
- Columns 11-15: NPLOT = Number of calculated data that follows.

**Lines 10-10a:** Results from prediction model in the same format as the data.

- Columns 1-80: Identical to lines 7-7a.

-> RETURN TO LINE 9!

**Line 13:** Indication about parameters to be written on the plot.

- Columns 1-5: NVAL = Number of parameters to be written in the list to the right on the plots. NVAL must be `_40`.

**Lines 14-14a:** Indication about values of the parameters on the plot.

- Columns 1-5: K = Number of first parameter (see below).
- Columns 6-10: VAL(K) = Value and dimension of first parameter.
- Columns 11-15: K = Number of 2nd parameter.
- Columns 16-20: VAL(K) = Value and dimension of 2nd parameter.
- Columns 21-25: K = Number of 3rd parameter (see below).
- Columns 26-30: VAL(K) = Value and dimension of 3rd parameter.
- Columns 31-35: K = Number of 4th parameter.
- Columns 36-40: VAL(K) = Value and dimension of 4th parameter.
- Columns 41-45: K = Number of 5th parameter (see below).
- Columns 46-50: VAL(K) = Value and dimension of 5th parameter.
- Columns 51-55: K = Number of 6th parameter.
- Columns 56-60: VAL(K) = Value and dimension of 6th parameter.
- Columns 1-60 on following lines: Continuation of the rest of the NVAL parameters.
- For key to list of parameters on each plot, see table A2.1:

Return to line 3 and repeat the information for a total of N3 times.

## 2.5 Plot-types 4, 5, 6 and 10

[back to the top](#)

**Lines 3-5:** General information

- Columns 1-60: Text to identify the plot.

**Line 6:** Symbol and scale on horizontal axis

- Columns 1-5 (integer): ISYMB = Symbol, according to Table A2.1, to be represented and written on horizontal axis.
- Columns 6-10 (real): ABSSYM(1) = Lowest value of scale on horizontal axis.
- Columns 11-15 (real): ABSSYM(2) = Middle value of scale on horizontal axis.
- Columns 16-20 (real): ABSSYM(3) = Highest value of scale on horizontal axis.

**Line 7:**

- Column 1 (I1): NSYM = Number for identification of symbol to be plotted. NSYM should only take the values 3, 4, 5, 7, 1 or 2 in order not to charge the figure too much. = 0 for end of information.
- Columns 2-5 (I4): NPLOT = Number of experimental data on the blade surface. NPLOT\_20.
- Columns 6-10 (I5): NVAR = Number of variables.
- Columns 11-16 (A5): VAL = Value of the variables.

**Lines 8-8a:** Experimental data as function of the parameter chosen

- Columns 1-10: Par(1) = Parameter-value of first experimental data
- Columns 11-20: A (1) = Amplitude of experimental data in first point
- Columns 21-30: f(1) = Phase angle of experimental data in first point

- Columns 31-40: Par(2) = Parameter-value of experimental data in 2nd point
- Columns 41-50: A (2) = Amplitude of experimental data in 2nd point
- Columns 51-60: f (2) = Phase angle of experimental data in 2nd point -> This line is repeated until all NPLOT values are given. -> Lines 7+8 are repeated until NSYM = 0

### Line 9: Scale on vertical axis

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value Line 10: Indication about prediction model or end of results.
- Columns 1-5: -> "0" if no more results are to be plotted -> Number of prediction model used (for definition, see Bölcs and Fransson [1986, pp. 41-42])
- Columns 6-10: LTYPE = Identification of the line type to be plotted for this prediction model.
- Columns 11-15: NPLOT = Number of calculated data that follows.

### Lines 11-11a: Results from prediction model in the same format as the data.

- Columns 1-80: Identical to lines 8-8a.

-> RETURN TO LINE 10!

### Line 12: Indication about parameters to be written on the plot.

- Columns 1-5: NVAL = Number of parameters to be written in the list to the right on the plots. NVAL must be \_40.

### Lines 13-13a: Indication about values of the parameters on the plot.

- Columns 1-5: K = Number of first parameter (see below).
- Columns 6-10: VAL(K) = Value and dimension of first parameter.
- Columns 11-15: K = Number of 2nd parameter.
- Columns 16-20: VAL(K) = Value and dimension of 2nd parameter.
- Columns 21-25: K = Number of 3rd parameter (see below).
- Columns 26-30: VAL(K) = Value and dimension of 3rd parameter.
- Columns 31-35: K = Number of 4th parameter.
- Columns 36-40: VAL(K) = Value and dimension of 4th parameter.
- Columns 41-45: K = Number of 5th parameter (see below).
- Columns 46-50: VAL(K) = Value and dimension of 5th parameter.
- Columns 51-55: K = Number of 6th parameter.
- Columns 56-60: VAL(K) = Value and dimension of 6th parameter.
- Columns 1-60 on following lines: Continuation of the rest of the NVAL parameters.
- For key to list of parameters on each plot, see table A2.1:

Return to line 3 and repeat the information for a total of N4, N5, N6 or N10 times.

## 2.6 Plot-type 7

[back to the top](#)

### Lines 3-5: General information

- Columns 1-60: Text to identify the plot.

### Line 6: Symbol and scale on horizontal axis

- Columns 1-5 (integer): ISYMB = Symbol, according to Table A2.1, to be represented and written on horizontal axis.
- Columns 6-10 (real): ABSSYM(1) = Lowest value of scale on horizontal axis.
- Columns 11-15 (real): ABSSYM(2) = Middle value of scale on horizontal axis.
- Columns 16-20 (real): ABSSYM(3) = Highest value of scale on horizontal axis.

**Line 7:** Scale to the left of vertical axis (cw)

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value

**Line 8:**

- Column 1 (I1): NSYM = Number for identification of symbol to be plotted. NSYM should only take the values 3, 4, 5, 7, 1 or 2 in order not to charge the figure too much. = 0 for end of information.
- Columns 2-5 (I4): NPLOT = Number of experimental data on the blade surface. NPLOT\_20.
- Columns 6-10 (I5): NVAR = Number of variables.
- Columns 11-16 (A5): VAL = Value of the variables.

**Lines 9-9a:** Experimental data as function of the parameter chosen For all standard configurations apart from number 4:

- Columns 1-10: Par(1) = Parameter-value of first experimental data.
- Columns 11-20: X(1) = Experimental aerodynamic coefficient data in first point.
- Columns 21-30: Par(2) = Parameter-value of experimental data in 2nd point
- Columns 31-40: X(2) = Experimental aerodynamic coefficient data in 2nd point.
- Columns 41-50: Par(3) = Parameter-value of experimental data in 3rd point
- Columns 51-60: X(3) = Experimental aerodynamic coefficient data in 3rd point. -> This line is repeated until all NPLOT values are given. For standard configuration 4:
- Columns 1-10: Par(1) = Parameter-value of first experimental data.
- Columns 11-20: X(1) = Experimental aerodynamic coefficient data in first point.
- Columns 21-30: X(1)-conf.int = 95% confidence interval of X(1) -> This line is repeated until all NPLOT values are given. -> Lines 8+9 are repeated until NSYM = 0

**Line 10:** Scale to the right of vertical axis (X)

- Columns 1-5: ORDSYM(1) = Lowest value
- Columns 6-10: ORDSYM(2) = Value at 1/4 of scale
- Columns 11-15: ORDSYM(3) = Middle value
- Columns 16-20: ORDSYM(4) = Value at 3/4 of scale
- Columns 21-25: ORDSYM(5) = Highest value

**Line 11:** Indication about prediction model or end of results.

- Columns 1-5: -> "0" if no more results are to be plotted -> Number of prediction model used (for definition, see Böles and Fransson [1986, pp. 41-42])
- Columns 6-10: LTYPE = Identification of the line type to be plotted for this prediction model.
- Columns 11-15: NPLOT = Number of calculated data that follows.

**Lines 12-12a:** Results from prediction model in the same format as the data.

- Columns 1-80: Identical to lines 8-8a.

-> RETURN TO LINE 11!

**Line 13:** Indication about parameters to be written on the plot.

- Columns 1-5: NVAL = Number of parameters to be written in the list to the right on the plots. NVAL must be \_40.

**Lines 14-14a:** Indication about values of the parameters on the plot.

- Columns 1-5: K = Number of first parameter (see below).
- Columns 6-10: VAL(K) = Value and dimension of first parameter.
- Columns 11-15: K = Number of 2nd parameter.
- Columns 16-20: VAL(K) = Value and dimension of 2nd parameter.
- Columns 21-25: K = Number of 3rd parameter (see below).
- Columns 26-30: VAL(K) = Value and dimension of 3rd parameter.
- Columns 31-35: K = Number of 4th parameter.
- Columns 36-40: VAL(K) = Value and dimension of 4th parameter.
- Columns 41-45: K = Number of 5th parameter (see below).
- Columns 46-50: VAL(K) = Value and dimension of 5th parameter.
- Columns 51-55: K = Number of 6th parameter.
- Columns 56-60: VAL(K) = Value and dimension of 6th parameter.
- Columns 1-60 on following lines: Continuation of the rest of the NVAL parameters.
- For key to list of parameters on each plot, see table A2.1:

Return to line 3 and repeat the information for a total of N7 times.