Guidance document
Industrial Fan Selection

rotodyne **asselbergs**
AIR TO MEASURE
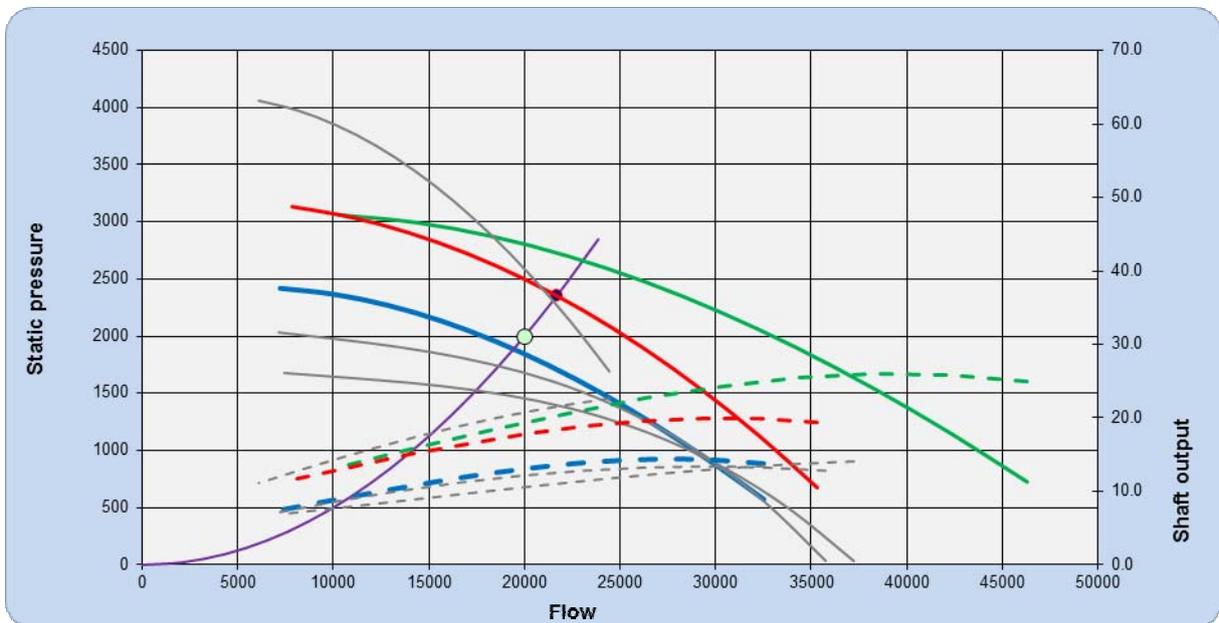
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Introduction

The fan selection tool is a handy and easy to use tool for selecting the appropriate fan by any individual not necessarily having an in-depth background in the subject. This tool was created in Excel which makes it easy to install on a desktop or laptop computer. In addition to facilitating the selection of the appropriate fan this tool also allows experts and novices alike to generate a fan data sheet and an associated drawing (for axial flow fans and D-type radial fans) instantaneously.

After the client created the appropriate fan the resulting specification sheet can be sent to Rotodyne whom will return a proposal for the selected fan.

Installation

This selection program requires Excel 2007 (or a newer edition).

To operate properly it is important to activate a number of macro's. Follow the next steps to this end:

1. Press the Office button   *Office-knop*
2. Select "Options for Excel"   *Opties voor Excel*
3. Select "Security center"   *Vertrouwenscentrum*
4. Select "Set up"   *Instellingen voor het Vertrouwenscentrum*
5. Select "Set up Macro's"   *Instellingen voor macro's*
6. Activate all macro's   *Alle macro's inschakelen*

Follow the next, simple procedure for installing the program. Copy the files "ROTODYNE Selection Vxx.xlsm", and "Drawing 2013.xls" to a directory where you want to install the selection program. This can either be a location on a network drive or on your local desk top. For certain types of fans you can generate a drawing for the synthesized fan. To this end it is important that the file "Drawing 2013.xls" is placed in the same directory as the selection program.

In specifying a new fan always start from the original sheet "ROTODYNE Selection Vxx.xlsm"***, because some cells may have been overwritten during an earlier specification.***

We strongly advise to save the original sheet with this program on a separate location on your network or system for reference at the onset of new fan specifications. If an error of some sorts occurs it is often easiest to reload the file to your system. We also recommend to set attributes of the two system files of the program, i.e. "ROTODYNE Selection Vxx.xlms", and "Drawing 2013.xls", to "read only" from the Windows Explorer environment.
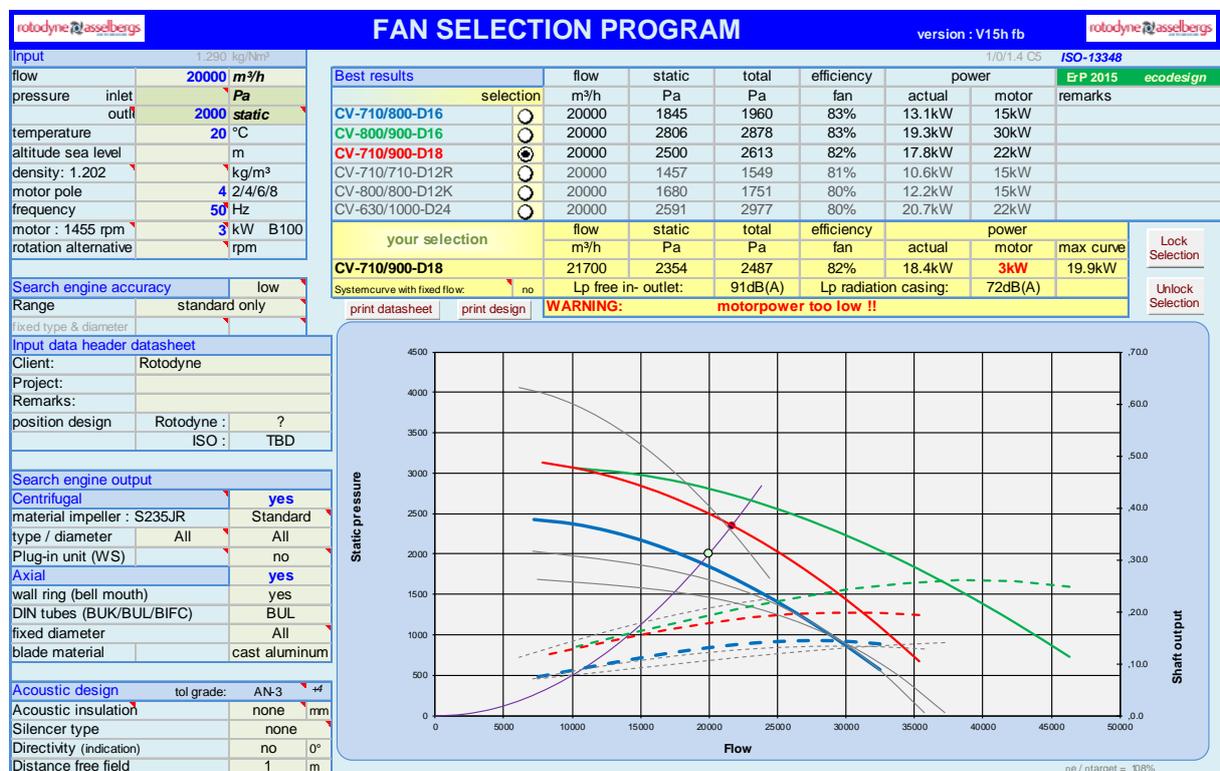
1. Selecting a fan

1.1 Getting started

Open the selection file "ROTODYNE Selection Vxx.xlms" from Excel. If the steps outlined in the Installation chapter were performed correctly, one can now start making a selection.

1.2 The selection screen

1.2.1 Choosing the type of fan

After opening the program the following view will appear

Before starting to specify a fan one can choose to search within all fans, only centrifugal or only axial flow fans. To exclude a specific type of fans one must use the "Search engine output" box.

Search engine output		
Centrifugal		**yes**
material impeller : S235JR		Standard
type / diameter	All	All
Plug-in unit (WS)		no
Axial		**yes**
wall ring (bell mouth)		yes
DIN tubes (BUK/BUL/BIFC)		BUL
fixed diameter		All
blade material		cast aluminum

Choose "no" for Centrifugal or Axial fan to exclude that specific type.

Guidance at the selection of a centrifugal fan
Your search within the centrifugal fans can be made more specific by specifying the following choices:
- material impeller: Left on "Standard" the program will select the best suitable material. If one prefers a specific material you can make a choice using the pull down menu box. Select the standard cell and click the pull down menu button.
- fixed diameter: Both left on "All" the program will select the best type of fan and impellar diameter.
  In the right box you can choose a preferred diameter and in the box on the left a specific type of impeller.
    - D-type: high efficiency, low noise generation, standard low- and medium pressure.
    - P-type: high pressure, non-standard, low- and medium pressure.
    - DAZ: double inlet fan, v-belt driven.
    - DS: dual stage fan. Two fans of approx the same size will be connected parallel, mounted on one skid.
- If one prefers to select a so-called plug-in unit (normally designed for use in oven and dryer machines) then select "yes" at the selection cell. Subsequently, four different options will appear in the pull down menu. Please note that due to the large number of variations in practice, the given curves are only indicative.
    - Standard: the machine has a spiral casing inside, i.e. same as the normal fan.
    - Double spiral: the machine has a spiral casing with an outlet on two sides.
    - Box 125%: no spiral casing but the impeller is free in two directions wide 1.8D
    - Box 100%: no spiral casing but the impeller is free in two directions wide 1.4D.
    - Box 50%: no spiral casing but the impeller is free in half of the directions.

Guidance at the selection of a axial fan
The search within the axial fans can be more clearly specified by the following choices:
- Choose "yes" for wall ring if you want to include wall ring mounted fans in the type search, selecting "no" will exclude them.
- Choose the type of tube the search has to include ("BUK" for short tube, "BUL" for long tube and "BIFC" for bifurcated tube). Choose "no" if the search is only to includewall ring mounted fans.
- For the tubes one can choose a fixed diameter using the pull down menu at the selection cell.
- If applicable, one can choose "yes" for an extended curve. This feature is only applicable to certain types of axial fans.

- Standard the blades are made of cast aluminum. It's also possible to choose all kind of plate steel materials.

If uncertain about the type of fan (axial/centrifugal) required, leave both types on "yes".

1.2.2 Selection parameters

Input	1.290	kg/Nm³
flow	**20000**	*m³/h*
pressure inlet		*Pa*
outlet	**2000**	*static*
temperature	**20**	°C
altitude sea level		m
density: 1.202		kg/m³
motor pole	**4**	2/4/6/8
frequency	**50**	Hz
motor : 1455 rpm	**3**	kW B100
rotation alternative		rpm

- Flow: enter in the required flow. Specify the units of the flow by the pull down menu in the selection cell "m³/h".
- Pressure: one can enter the required pressure the fan has to produce. Choose the units selection cell "Pa" to change it into the required units. Choose the "static" selection cell to alter between static or total pressure. In situations where (under)pressure conditions occur at inlet this must be entered at the inlet cell (minus for under pressure or suction). The density will be adjusted.
- Specify the operating temperature of the fan. This will also cause adjustment of the density.
  - o Temperatures up to 1000°C can be specified. Above the 500°C the range will be altered to "not standard included". The range will be restricted just to the fans suitable for high temperatures.
  - o For temperatures above 620°C one can toggle between strength calculations based on 100.000h or 10.000h.
  - o Change the material button to "all materials" if there are no restrictions. The selection program will then choose the best material.
- One can specify the height of the installed fan above sea level if applicable. It will adjust the density (not specifying something in this cell in will not have have any consequences).;
- If required to overrule the density of the medium (not influenced by other parameters) one can enter it in the density cell. When entering a value here the fan selection will be calculated with the specified value throughout, and the latter will not be changed if in response to changing related parameters such as for example the temperature.
- Enter the desired number of poles of the motor (this parameter is related to the motor rotation speed: 2-pole for 3000 rpm, 4 pole for 1500 rpm, etc.).
- Choose the motor supply frequency 50Hz or 60Hz. Alternatively, a value can be entered, for example a frequency controlled motor. The selection program will notify that this is not a standard frequency.
- If available an indication of the power consumption of the motor can be specified. This value can be adjusted to match the required power for the selected fan. After choosing a different motor it is possible that the rotation speed is changed and the program needs a new selection. The warning "please choose again"   will consequently appear.

- For V-belt driven fans or specified, fixed rotation speed set the required speed in the "rotation alternative cell" cell. Take care with the rotation speed of a V-belt driven fan, as there are only fixed pulley combinations resulting in discrete speed ratios.
- In case you have different "Normal cubic meters" you can alter this at the top of the Input box. In almost all cases it should be left on 1.29kg/Nm³.

Entering and/or changing these parameters will result in all possible fans being displayed in the right top of the screen.

1.2.3 Selecting a fan

IEntering all parameters and search limitations leads to the result set showing the selected fans within the product portfolio of Rotodyne.

Best results		flow	static	total	efficiency	power		ErP 2015	ecodesign
selection		m³/h	Pa	Pa	fan	actual	motor	remarks	
CV-710/800-D16	○	20000	1845	1960	83%	13.1kW	15kW		
CV-800/900-D16	○	20000	2806	2878	83%	19.3kW	30kW		
CV-710/900-D18	◉	20000	2500	2613	82%	17.8kW	22kW		
CV-710/710-D12R	○	20000	1457	1549	81%	10.6kW	15kW		
CV-800/800-D12K	○	20000	1680	1751	80%	12.2kW	15kW		
CV-630/1000-D24	○	20000	2591	2977	80%	20.7kW	22kW		
your selection		flow	static	total	efficiency	power			Lock Selection
		m³/h	Pa	Pa	fan	actual	motor	max curve	
CV-710/900-D18		21700	2354	2487	82%	18.4kW	**3kW**	19.9kW	
Systemcurve with fixed flow:	no	Lp free in- outlet:		91dB(A)	Lp radiation casing:		72dB(A)		Unlock Selection
print datasheet	print design	WARNING:		motorpower too low !!					

If the list contains a suitable fan it can be selected with the selection button. Before making this selection do select the correct motor power (most right column shows the required motor power for the complete curve) first. Use the pull down menu in the selection parameters input box to select the appropriate motor power.
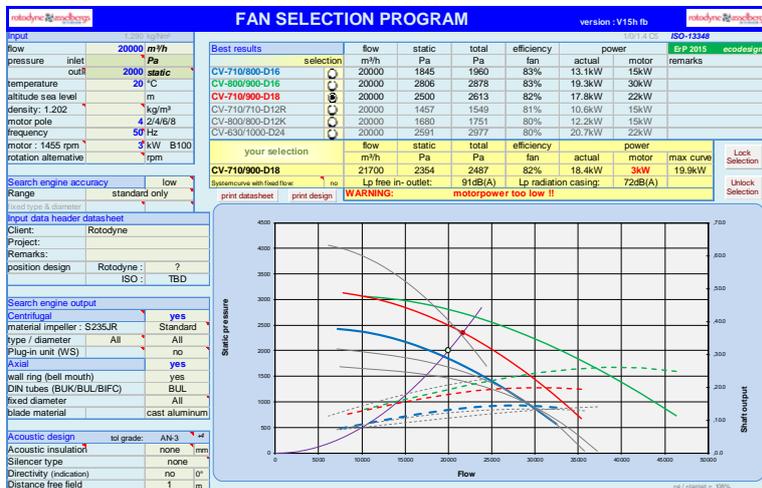
Note that the first 3 colors of the result correspond with the fan curves in the presented graphs. This facilitates choosing a curve that best fits your application.

If one suspects that the appropriate fan is not in the list, or if there is no results at all, one can try to change the search database.

Search engine accuracy	low
Range	standard only
fixed type & diameter	

Change the range from "standard only" to "non-standard included". Note that the "standard only" fans can be delivered in shorter delivery times and are financially more attractive

The search engine accuracy can be changed to "middle" or "high" if it is suspected that the result lies to far from the desired requirements.
In case a fan type is well known you can select the specific type and diameter from drop down menu "fixed type & diameter". The button will become green and the search engine is overruled.

Once a fan has been selected it will be displayed in the selection box (yellow). If applicable, there can be a message or warning (such as motor power too low). An attempt should be made to resolve this by changing the selection parameters. Some warnings, such as starting time for example, have to be verified by a Rotodyne engineer. Resolving these warnings require some expertise or system knowledge and need to be addressed when discussing your selection with Rotodyne.

your selection	flow	static	total	efficiency	power				
	m³/h	Pa	Pa	fan	actual	motor	max curve		Lock Selection
CV-710/900-D18	21700	2354	2487	82%	18.4kW	3kW	19.9kW		
System curve with fixed flow: no	Lp free in- outlet:		91dB(A)	Lp radiation casing:		72dB(A)			Unlock Selection
print datasheet print design	WARNING:			motorpower too low !!					

If the chosen fan is appropriate, the "Lock Selection" button can be used to focus on this fan only. The parameters associated with the selected fan can now be fiddled with to investigate their influence on this fan. Press the "Unlock Selection" button if you want to start a new selection.

System curve with fixed flow: if "yes" is selected the flow of the working point will be fixed and only the pressure will float. If "no" is selected (default setting) both flow and pressure will be adjusted.

Changing the generated acoustic noise characteristics

If the selected fan produces too much noise for the considered application a sound attenuator and/or acoustic isolation can be opted for.

Acoustic design	tol grade:	AN-3	+4
Acoustic insulation		none	mm
Silencer type		none	
Directivity (indication)		no	0°
Distance free field		1	m

For the isolation of the housing use the pull down menu and select the isolation thickness. The result for the sound pressure level will be displayed immediately in the yellow selection box at "Lp radiation housing". In the same way a choice can be made between standard sound attenuators to reduce the sound pressure level at the out- and/or inlet. More detailed information on the acoustic performance of the fan can be found on the datasheet.
If there is a specific directivity you can choose a angle of directivity. Standard (selection "no") the directivity will be spherical.
Standard tolerance grade: AN-3

1.2.4 Printing the resulting selection
Having selected an appropriate fan one can directly print the fan data sheet. Push the "print datasheet" button and the selection program will generate the print example of the data sheet. Then print it to a printer or to Adobe for a pdf-file.

Do specify information about your company and the project (reference) at the "input data header datasheet". This information will be shown at the fan data sheet and the drawing. You can also choose an orientation of the outlet. (design position)

Input data header datasheet		
Client:	Rotodyne	
Project:		
Remarks:		
position design	Rotodyne :	?
	ISO :	TBD

A drawing can be generated for some types of fans. In the current version of the selection program the drawings for axial wall rings, BIFC, BUK and BUL can be generated. Drawings for the D and P-type fans are also included. Rotodyne will continue to extend the database so that drawing for other types can also be generated in future.

2. Technical parameters and mathematical equations

The extra tab "f(x)" is added for technical use. If mathematical conversions from measurement to data are needed in the PLC one can copy and paste the equation in cubic format from this excel sheet. However, at present this can only be used for centrifugal fans.

- Normally the curves of a fan have the flow along the x-axis of the floww graph, the pressure on the y-axis on the left and the shaft power on the right y-axis. The cubic equation of these curves can be found in the A chapter of the tab f(x).
- One often has a given pressure but needs to know the corresponding flow at a certain rotation speed and temperature. The required equation can be found in the B chapter. The only remaining problem is the possibility of two results at the same time. This requires confining the curve to the desired area. The thin black curve gives the accuracy of the defined equation.

Q=f(Pst)
restricted area

cut off static pressure			Q	Pst	
			m³/h	Pa	
curve restriction		1	44410	678	-MIN PRESSURE
cut off	1	2	39480	1105	
		3	34540	1468	
		4	29610	1769	
		5	24670	2014	
		6	19740	2205	
curve restriction		7	14800	2346	
cut off	8	8	9870	2439	-MAX PRESSURE
		9			
		10			

Simply alter the "cut off" amount (in this case 1 and 8) and decide if the created curve suits the needs. The "min pressure" and the "max pressure" give the range of the equation.

- Chapter C the same, only now the input is the shaft power. In the case that only the current or supply power, i.e. one of the electrical power quantities, is available, first transform these quantities to the (mechanical) shaft power.

3. Receiving a proposal

After sleceting an appropriate fan a commercial proposal can be solicited from Rotodyne by completing the Inquiry sheet.

Please use the button on the "inquiry sheet" to send your request to your preferred Rotodyne relation (from the list) or to the general address at sales@rotodyne.nl. We will respond promply.

If any additional specifications need to be considered a note can be added in the area labeled "remarks" on the "inquiry sheet". Alternatively it can be described in the message accompanying the request. We will take consider these additional specifications in a complete proposal.

4. Assistance

Please do not hesitate to contact Rotodyne when needing assistance. Please also report faults or a lack of clarity in selections to Rotodyne.

Our contact data:
Rotodyne Ventilatoren B.V.
Keizersveld 14
5803 AN Venray
Tel.: +31 478 559955
Fax.: +31 478 559900
e-mail: info@rotodyne.eu

You can of course always contact your contact at Rotodyne for assistance.

5. Revision

02	- installation: activate iterative calculation
03	- DAZ: double inlet fans.
	- Inquiry sheet
	- Activate iterative calculation not necessary any more.
04	- fixed flow
05	- overall appearance
06	- No solver needed.
	- DS: Dual Stage fans.
	- Acoustic design: tolerance grade and directivity
	- fixed type & diameter
	- documentation ecodesign ErP
07	- general update.