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Data base for Design Fires -Brandforsk Project 327-021

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Abstract

Fire safety engineering and fire modelling are important tools in the building design process. These analyses require background fire test data in order to create design fires and make correct assumptions. There is a need for a commonly available resource for fire test data. With this objective a data base has been designed with the aim to store and make available fire test data via the Internet. Access to the data base is free and a user can make detailed searches for different materials and products using keywords and fire test parameters. In this first stage test data mostly from linings are imported for three major fire test methods, the Cone Calorimeter, the SBI and the Room/Corner Test. The data base is published at SP's website and will be extended shortly with more data also from real-scale tests such as tunnel experiments.

Key words: Data base, database, fire, test, material, design fire

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Preface

This project was sponsored by the Swedish Board for Fire Research (Brandforsk) with the project reference number 327-021.

Acknowledgement is also given to the staff at SP Fire Technology involved in this project. Special thanks to Mats Olsson, SP and NYCE who did most of the programming work in the design phase. We would also like to acknowledge Daniel Johansson who helped a lot during the data importing process.

Sammanfattning

Denna rapport beskriver utvecklingen av en databas för data från brandprovningar. Större delen av rapporten utgör även manual för användare.

Databasen har ett Internetbaserat användargränssnitt och den är gratis att använda efter att man registrerat sig. I ett första skede har data från tre olika brandprovningsmetoder importerats, Konkalorimetern, SBI, och Room Corner Test. Dessa data kommer från ett flertal forskningsprojekt som har genomförts under de senaste 10-15 åren. Databasen kommer kontinuerligt att utökas med fler data från andra provningsmetoder och även från fullskaliga provningar som t.ex. tunnelprovningar.

1 Scope

The aim of this project is to develop a data base containing test data from a large number of fire tests. The type of tests is ranging from small-scale standard fire tests on individual materials to real-scale tests with e.g. cables or furnished rooms. The data base is fully interactive and freely accessible to the public via the Internet. It includes advanced search possibilities and export functions, which allow data to be used for fire research and development of design fires. This report and manual describes the status of the data base as of 2005-01-01.

2 Design of the data base

A large effort has gone into planning of the structure of the data base. Important items are how to store data, how to make an easy-to-use interface for importing data from a large variety of tests with different data layout and formatting. It is also of great importance to characterize the data in a logical way using a set of keywords. This chapter gives a summary of the functions included and is also partly intended to be a manual for the user. Further information can be found in Annex A, Help Pages.

2.1 Data storage

All data is stored in XML (Extensible Markup Language) format. The application is developed in Microsoft.NET framework and uses SQL Server 2000.

2.2 Data search and export interface

The heart of the data base and the part visible to public users is the search and export module. The module is accessed via an Internet interface and requires no special software installation from the user side. The only thing required is for the user to register with name, address and email. After registration a password will be sent to the user by email.

2.2.1 Search data

In the search module it is possible to do searches of the data base using an easy or advanced search mode. A search is made by entering keywords describing the material and test. The keywords are material, product, object, scenario, method and reference. One or several of the keywords can be specified depending on how narrow the search should be. For example, if the user is interested in Plywood data, simply enter the material keyword “Plywood” and specify a test method or search over all methods as shown in the example in Figure 1.

The advanced search mode adds the possibility to further focus a search by using scalar data. The scalars are specific for each test method and can include parameters such as peak heat release rate, smoke data, thickness and density of the material, etc. Note that a method keyword must be selected to access the advanced mode. For the scalar values it is possible to use the Boolean operators < (less than) and > (larger than) to define groupings of test data. An example is shown in Figure 2 where a search is made for Plywood tested at 25 kW/m^2 in the cone calorimeter with a time to ignition longer than 60 s.

The search results are presented in a list as shown at the bottom of Figure 1.

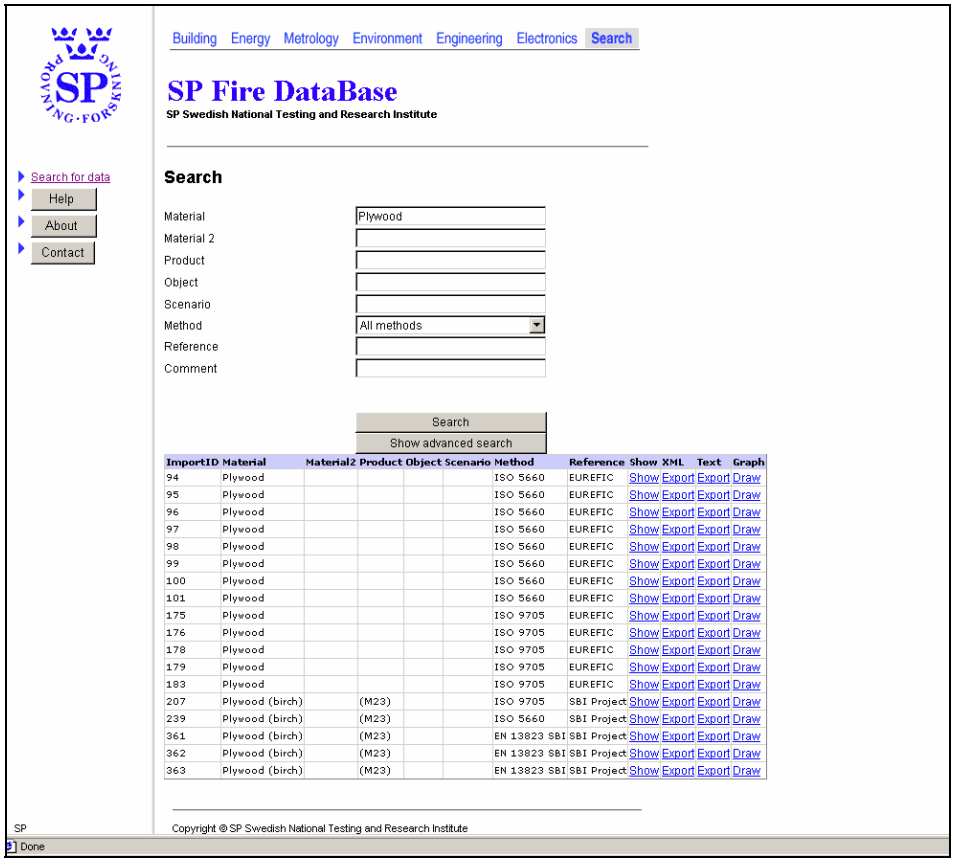


Figure 1. Example screenshot from the data base search interface.

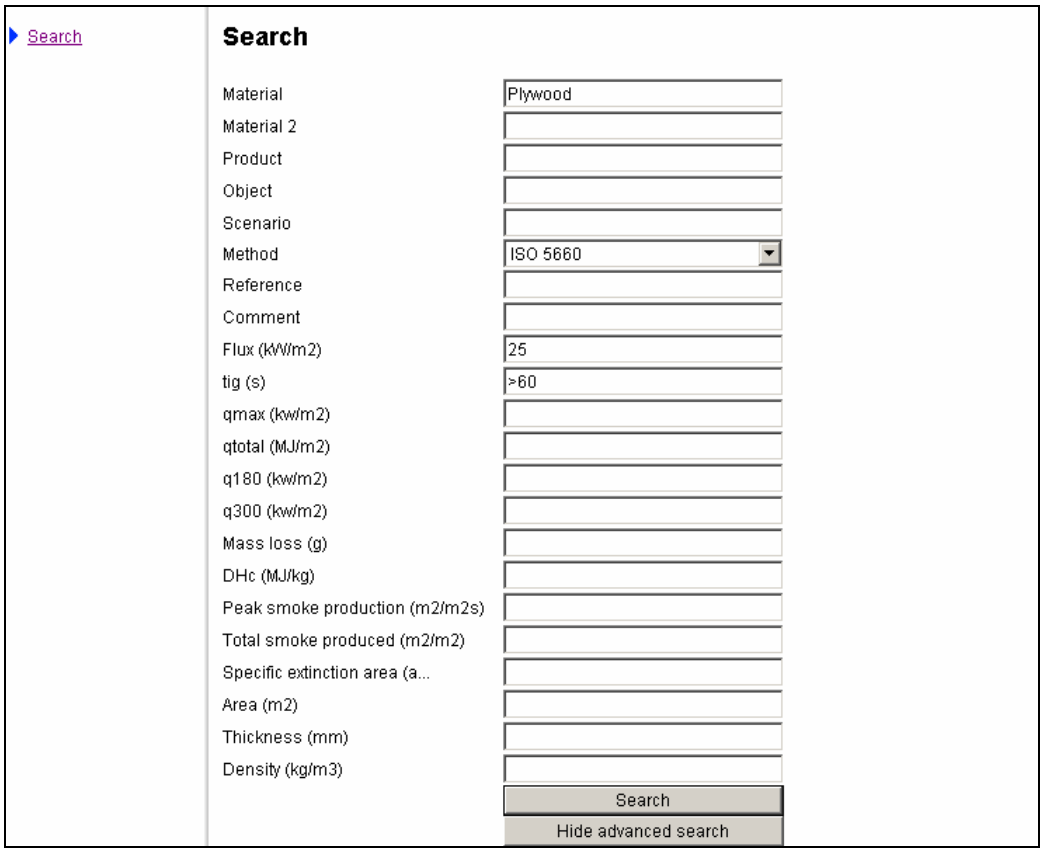


Figure 2. Example screenshot of a search in the advanced mode.

2.2.2 View or export data

When a successful search has been made there are four actions possible for each hit; Show, Export to Text or XML and Draw. Show will present a summary of the data set with all keywords, scalar data and the vector data, see Figure 3. The Export options will export a text file, either as an ASCII semi-colon separated file or as a XML file. The ASCII file can be opened in any text editor or graph program and the XML file can be opened in e.g. MS Office 2003 or later. Finally Draw will plot a graph of the data available in the chosen data set, generally heat release rate and smoke production rate, see Figure 3.

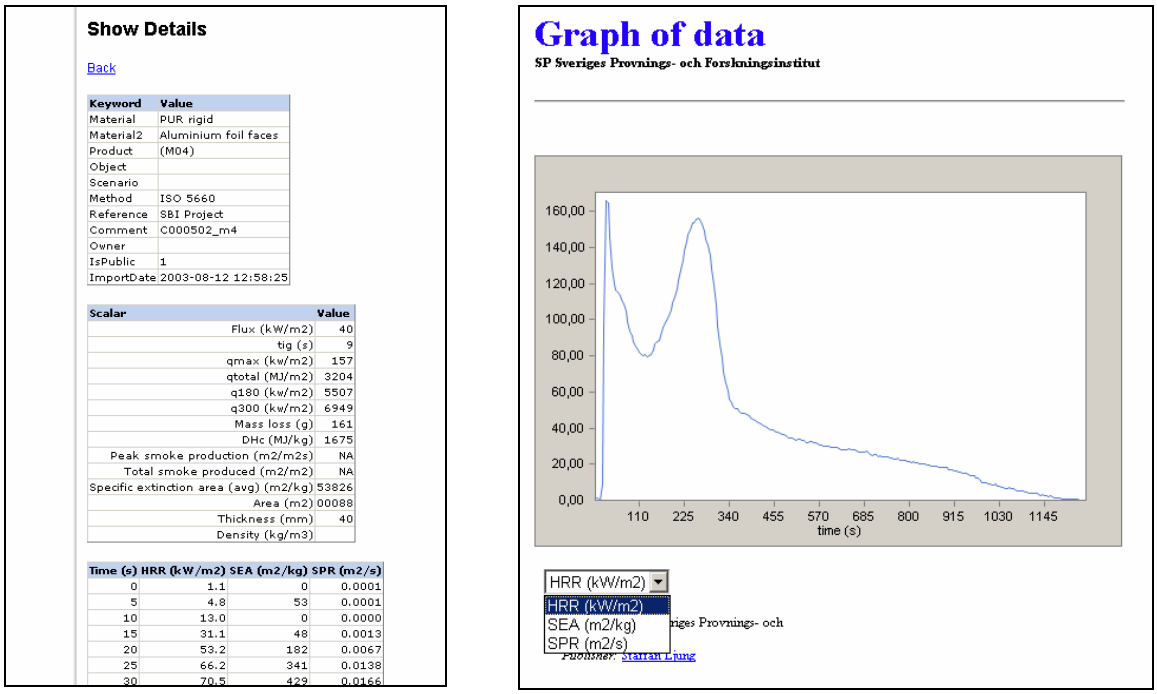


Figure 3. Example screenshots of the Show and Draw functions, generated after a search.

3 Collection and formatting of data

Searches have been made to find public data from various research projects during the last 15 years, conducted at several research institutions. Focus has been on finding data from ISO 9705 (Room Corner Test), EN 13823 (SBI) and ISO 5660 (Cone Calorimeter). The data has been formatted in a suitable way and then imported into the data base. In some cases simple conversion programs were used to format the data, e.g. from the FDMS format to column-formatted ASCII.

4 Internet access

The data base is published for anyone to use through the main SP website at the address www.sp.se/fire/fdb. New users are required to fill in a user form with basic information and an email address. After submission an email is sent (instantly) from the data base to the user containing a username and a password. Once logged in the user will be able to access the search modules mentioned above.

The import and maintenance module is also accessed and worked through the Internet but this module is only accessible to SP staff.

5 Data import and maintenance wizard

This chapter describes the data import and maintenance wizard. The functions in this module are only accessible to SP staff and not relevant for the normal user.

5.1 Data import

The internet-based data import and maintenance module is constructed as a stepwise wizard which allows a very flexible way of previewing data and selecting what to import to the data base. The module can save settings for a specific definition of a data file and make repetitive imports. It is easy to create new sets of definitions and file types. The module is accessed through an Internet browser at the SP Intranet and is only accessible to SP staff. The first page gives a choice between Import and Maintenance. Below is a presentation of the stepwise import process that also functions as a manual. The Maintenance function is explained in the next section.

In this example we make an import of fire test data from an SBI test on a paper faced glass wool insulation sheet. Figure 4 shows the first step where material keywords are entered, the test method specified from the drop-down list and any comments entered. Press Next for step 2. You can also open a previously saved import set-up that applies to all the following steps.

If the test method does not exist in the list it is added simply by typing the name and standard number in the test method field and press Next. The wizard will then automatically show a sub-step 1b that let you specify which scalar data fields you want to include for this test method. See Figure 7 for examples of scalar fields for the SBI test.

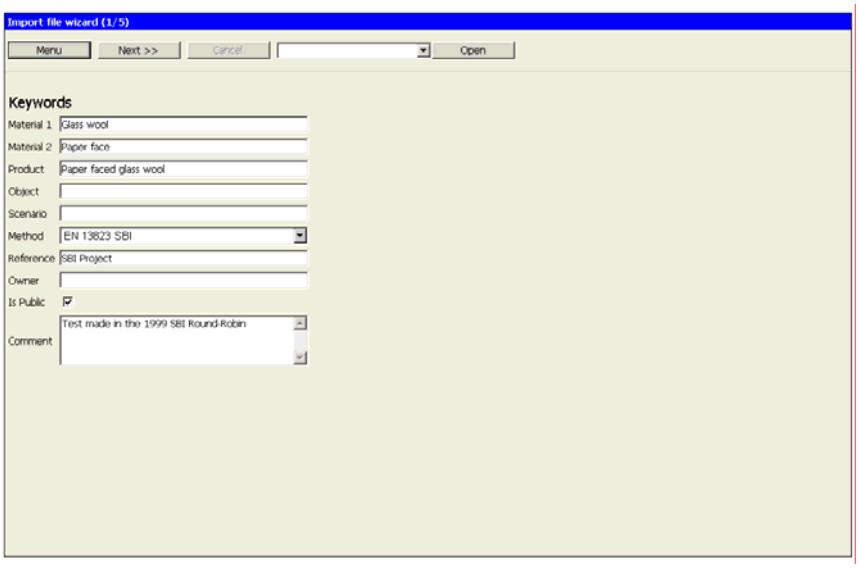


Figure 4. Data import example step 1.

Figure 5 shows the next step, which is to specify the data file. This is done by clicking the browse button and locating the file. The delimiter or separator must also be specified, e.g. comma separation for a .csv file.

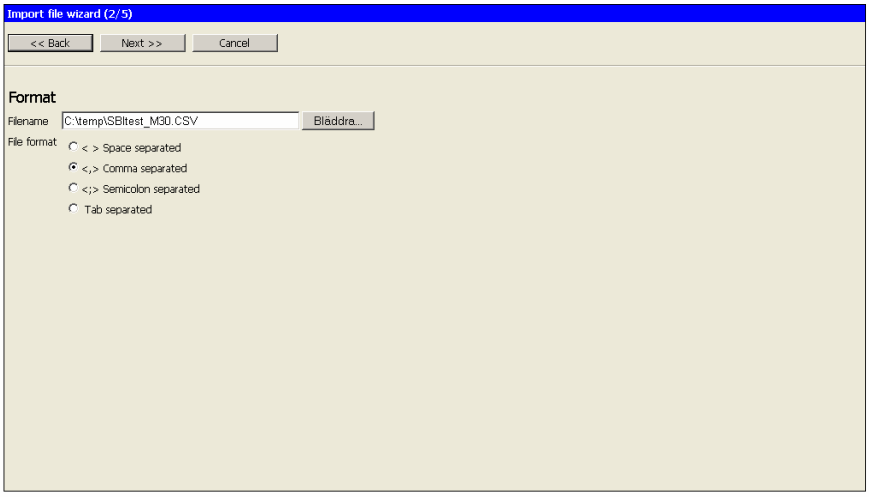


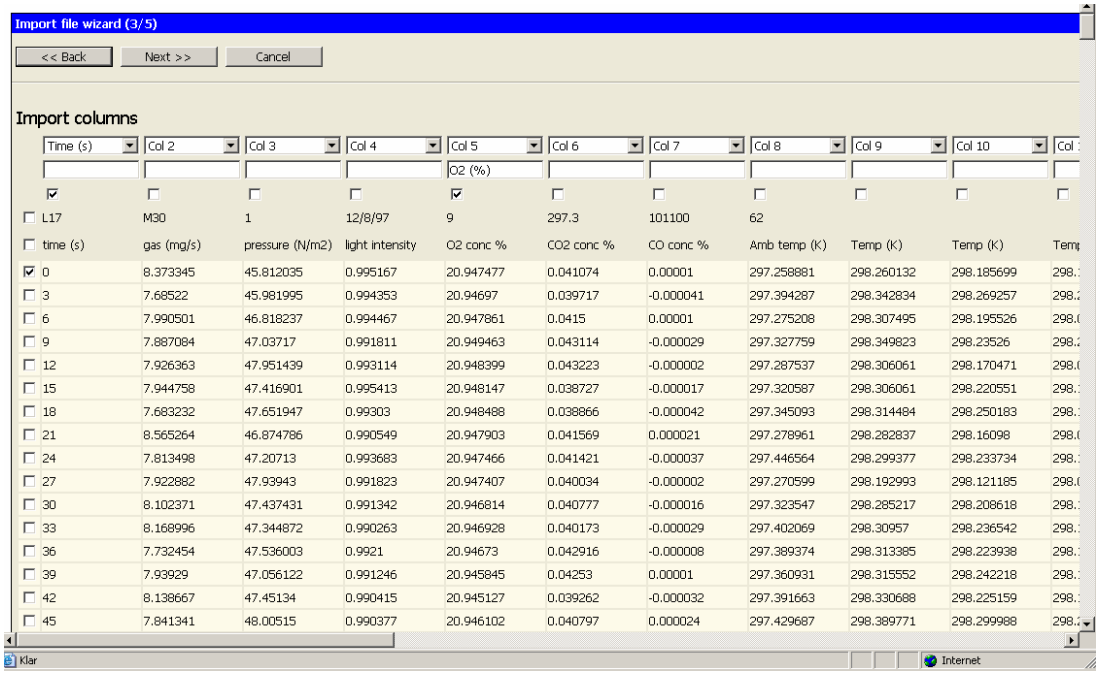
Figure 5. Data import example step 2.

After clicking Next the Import module will analyse the file and present a preview of the data in columns as shown in Figure 6 below. In this step the user makes a selection of which data to import by marking columns and rows.

For most tests the relevant columns are time, heat release rate, smoke production, weight loss if applicable and in some cases gas concentrations and temperatures. In the Figure 6 example we have checked the first and the fifth columns, time and O_2 concentration. The column headers should also be specified, either by the drop-down list which we have used on the time column, or by typing the column header like in the O_2 column. In this example there are additional columns further to the right in the window.

The rows to import are selected by marking the checkboxes for the first and last row of interest. Data files from different software often contain several rows with scalar information that is not necessary to import. Normally the first row imported should be the

row where the actual data values start, in this case at time = 0 s, i.e. the column headers should not be included (they are defined above). The last checked row is at time = 1800 s (scroll down). All rows that will be imported are highlighted in a brighter tone.



	Time (s)	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col
					O2 (%)						
	☑	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
☐	L17	M30	1	12/8/97	9	297.3	101100	62			
☐	time (s)	gas (mg/s)	pressure (N/m2)	light intensity	O2 conc %	CO2 conc %	CO conc %	Amb temp (K)	Temp (K)	Temp (K)	Temp
☑	0	8.373345	45.812035	0.995167	20.947477	0.041074	0.00001	297.258881	298.260132	298.185699	298.
☐	3	7.68522	45.981995	0.994353	20.94697	0.039717	-0.000041	297.394287	298.342834	298.269257	298.
☐	6	7.990501	46.818237	0.994467	20.947861	0.0415	0.00001	297.275208	298.307495	298.195526	298.
☐	9	7.887084	47.03717	0.991811	20.949463	0.043114	-0.000029	297.327759	298.349823	298.23526	298.
☐	12	7.926363	47.951439	0.993114	20.948399	0.043223	-0.000002	297.287537	298.306061	298.170471	298.
☐	15	7.944758	47.416901	0.995413	20.948147	0.038727	-0.000017	297.320587	298.306061	298.220551	298.
☐	18	7.683232	47.651947	0.99303	20.948488	0.038866	-0.000042	297.345093	298.314484	298.250183	298.
☐	21	8.565264	46.874786	0.990549	20.947903	0.041569	0.000021	297.278961	298.282837	298.16098	298.
☐	24	7.813498	47.20713	0.993683	20.947466	0.041421	-0.000037	297.446564	298.299377	298.233734	298.
☐	27	7.922882	47.93943	0.991823	20.947407	0.040034	-0.000002	297.270599	298.192993	298.121185	298.
☐	30	8.102371	47.437431	0.991342	20.946814	0.040777	-0.000016	297.323547	298.285217	298.208618	298.
☐	33	8.168996	47.344872	0.990263	20.946928	0.040173	-0.000029	297.402069	298.30957	298.236542	298.
☐	36	7.732454	47.536003	0.9921	20.94673	0.042916	-0.000008	297.389374	298.313385	298.223938	298.
☐	39	7.93929	47.056122	0.991246	20.945845	0.04253	0.00001	297.360931	298.315552	298.242218	298.
☐	42	8.138667	47.45134	0.990415	20.945127	0.039262	-0.000032	297.391663	298.330688	298.225159	298.
☐	45	7.841341	48.00515	0.990377	20.946102	0.040797	0.000024	297.429687	298.389771	298.299988	298.

Figure 6. Data import example step 3.

The next step is to enter scalar data for the test. The scalar data fields appearing in this step depend on the present test method. It is not necessary to enter all fields, just leave the field empty if no data is available. The Maintenance function also allows addition and correction of scalar data at a later stage, see section 5.2.

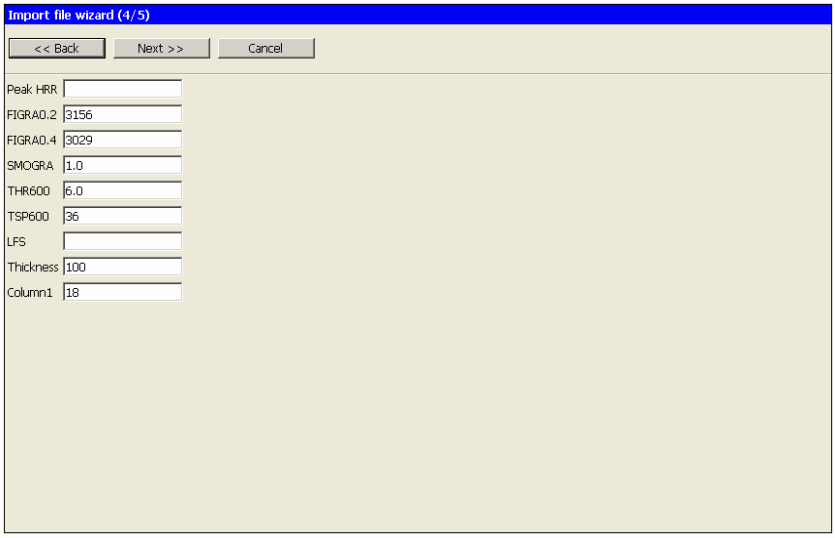


Figure 7. Data import example step 4.

Finally in step 5 a summary of the import object is presented. Click Finish to finalise the import process and return to the first step for importing another data set. During the next and following imports all fields that were entered during the previous import will keep the data, i.e. keywords and scalar data will contain text and values from the last data set.

The same applies to the selections made and the headers in the vector data step. This applies during the same Internet “session” and is helpful for saving time during repetitive imports from the same test method or project. It is also possible to save the settings (vector data selections and column headers) for a specific import or test method with the Save button during step 5. The saved settings can then be opened at a later session in the first stage using the Open button, see Figure 4.

5.2 Data Maintenance

The data imported into the data base can be maintained and corrected in two ways, either by directly accessing the data base file via an external data base program, or by using the built-in maintenance function. The former alternative should only be used by users well acquainted with the structure of data bases since there is a risk of corrupting the file.

By choosing the Maintenance option the user is presented with a search interface identical to the public search page. How to search is described in detail in chapter 2.2.1 and Annex A. The search function is used to find the material in question and by clicking “show” all information will be displayed as shown in Figure 8. Here the user can edit the keywords and the scalar data and just click Save when done. A data set can be removed by clicking Delete. Editing or updating the vector data is best done by deleting the data set and redo the full import with a corrected original vector data text file.

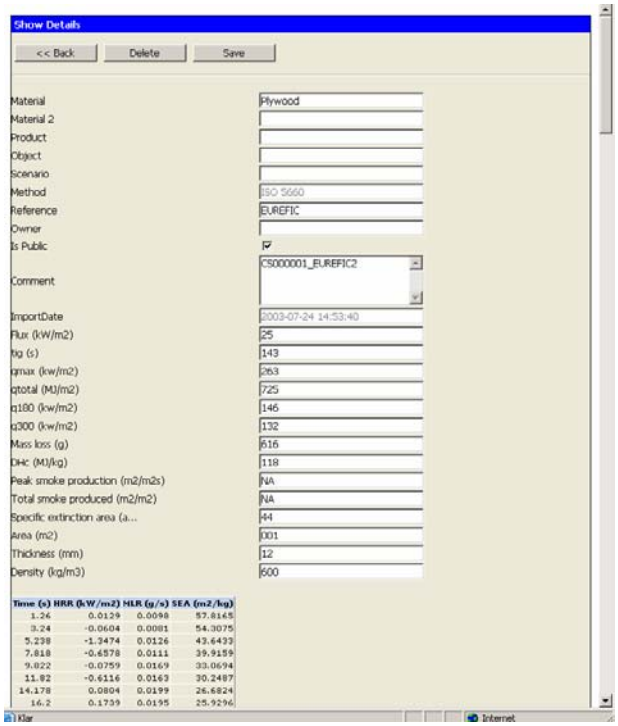


Figure 8. Maintenance of a data set.

Annex A On-line help

This annex contains the help pages that are published online and are accessible via the data base interface.

A.1 Welcome to the SP Fire Data base!

This data base is a free to use tool provided by SP Fire Technology. The concept is to store publicly available data from fire tests in a way that allows easy access. An internet-based user interface allows anyone to use it without extra software installation.

A.2 Search for data

To search for data click the Search link to arrive at the Search page. The search is made by filling in one or several search fields. The fields in the simple search mode are general and common for all test methods but in the advanced search mode the fields are specific depending on the test. A description of the fields are given below.

There is a logical AND between all search strings that means that the more fields you enter the more you narrow the search result.

A.2.1 Simple search mode

The simple search mode is common for all data sets and test methods.

Table 1. Simple search mode options

Search field	Description	Examples
Material	Short description of the material tested. For composite products this is mostly the “main” material. For cables this keyword should describe the sheath.	FR particle board, Mineral wool faced PUR rigid PVC wall carpet
Material 2	If several materials, composites, substrates. For cables this keyword should describe the insulation.	Plasterboard Mineral wool Calcium silicate board
Product	Generic product name, i.e sandwich panel, cable. Can also be product codes from research projects, i.e Mxx in the SBI project.	Cable, water pipe, sandwich panel, acoustic tile.
Object	Object tested in non-standard tests, mostly full-scale.	Sofa, trailer, cable ladder
Scenario	Short description of scenario in non-standard tests, mostly full-scale.	fipec horizontal cable reference scenario, furnished room 20 m^2
Method	Standardised fire test when relevant.	ISO 5660, EN 13823
Reference	Reference to the data source, i.e. a research project.	EUREFIC, SBI project, CBUF
Comment	Any comments, can also contain further description and information about the data or the test	

A.2.2 Advanced search mode

The advanced search mode adds the possibility to make searches using scalar data. The scalars are specific for each test method and the keywords described in Table 1 can still be used in the search. Scalar data can be derived parameters or physical data of the material or product. Note that you have to select a method (see Table 1 above) to access the advanced mode. The scalar parameters are self-explanatory but a few examples are given below.

For scalar values it is possible to use the Boolean operators < (less than) and > (larger than) to define groupings of test data.

A.2.3 Example searches

1 - Assume you want to find ISO 5660 Cone Calorimeter data for plywood that has an ignition time of more than 60 s at an irradiation level of 25 kW/m^2. A search in the advanced search mode should then look like in Figure 9.

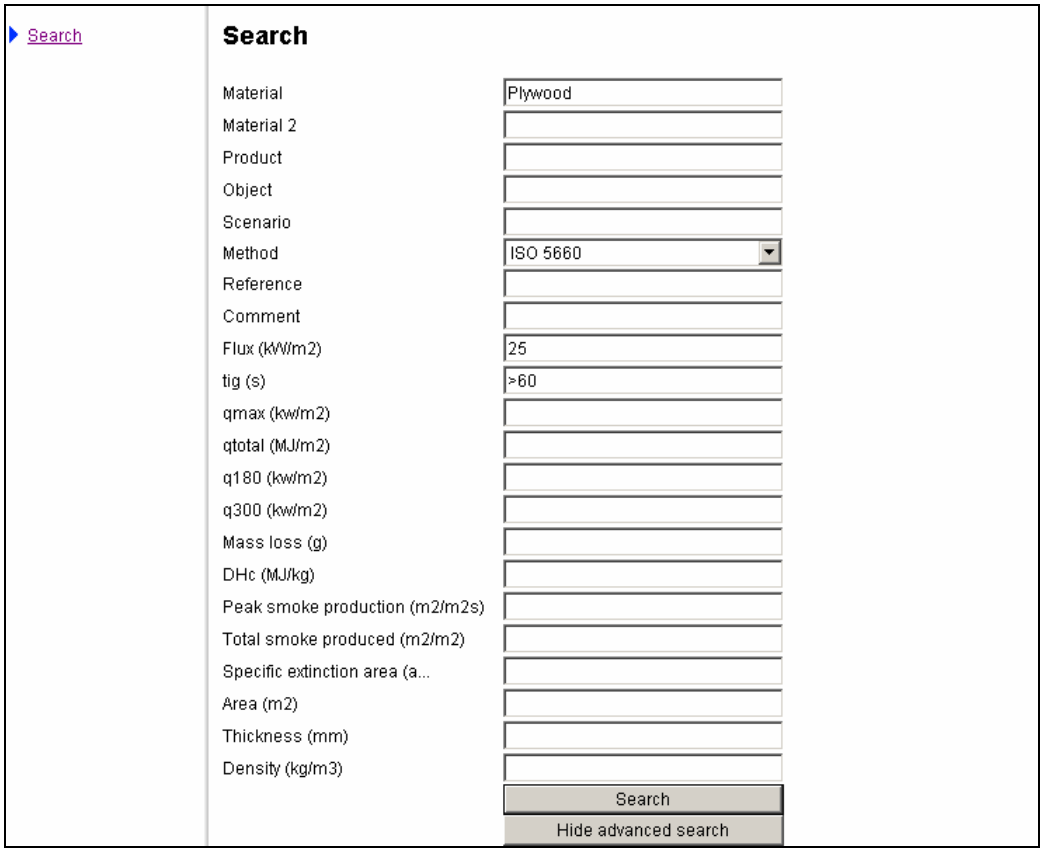


Figure 9. Example of a search in the advanced mode.

2 - Assume you want to see data of PVC cables tested in the SBI. A search in the simple mode can look like in Figure 10 below. The search can be further specified e.g. by entering an insulation like XLPE in the Material 2 field.

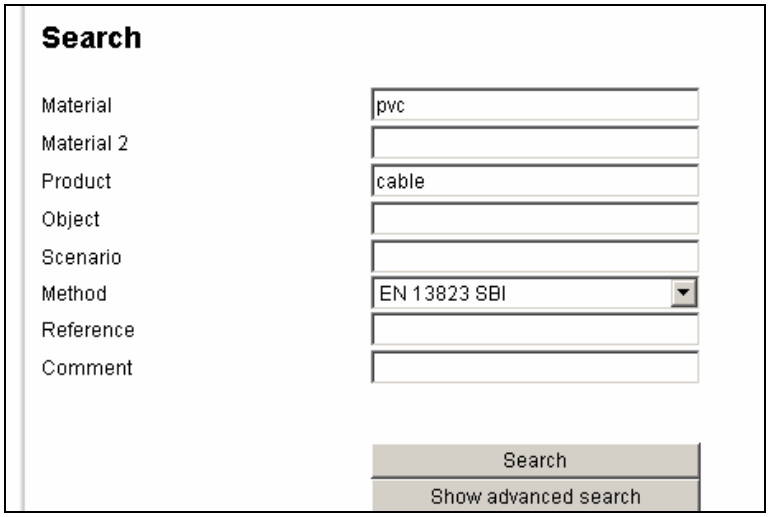
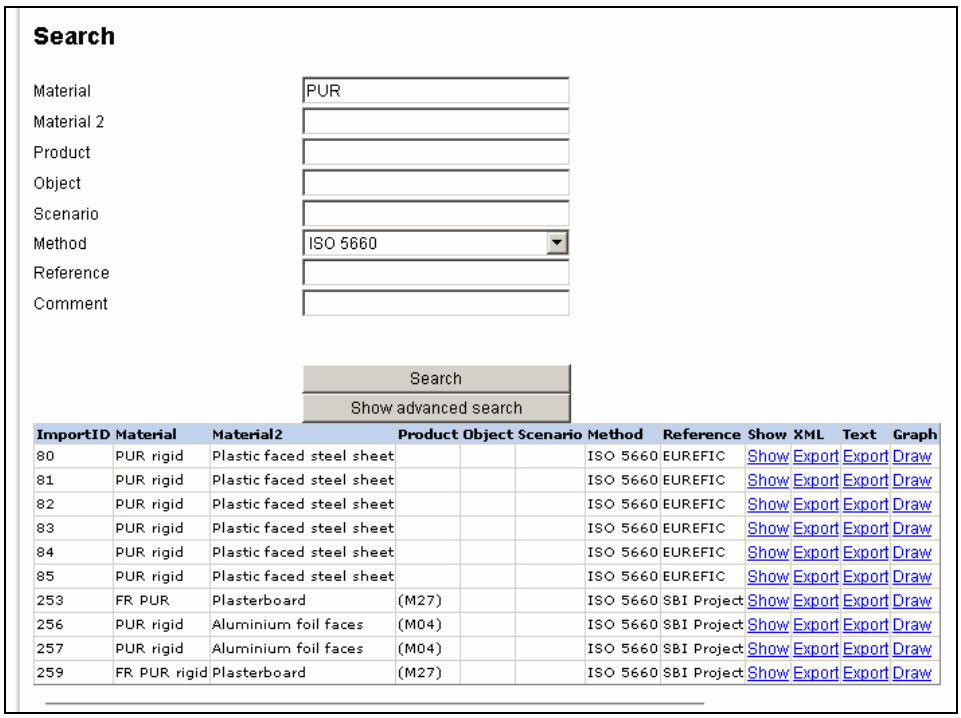


Figure 10. Example of a search in the simple mode.

A.2.4 Display and export search results

When a successful search has been made a list will appear showing the resulting hits at the bottom of the page, like in Figure 11. For each result there are four actions possible according to the links to the right in the results table; Show, Export to Text or XML and Draw.

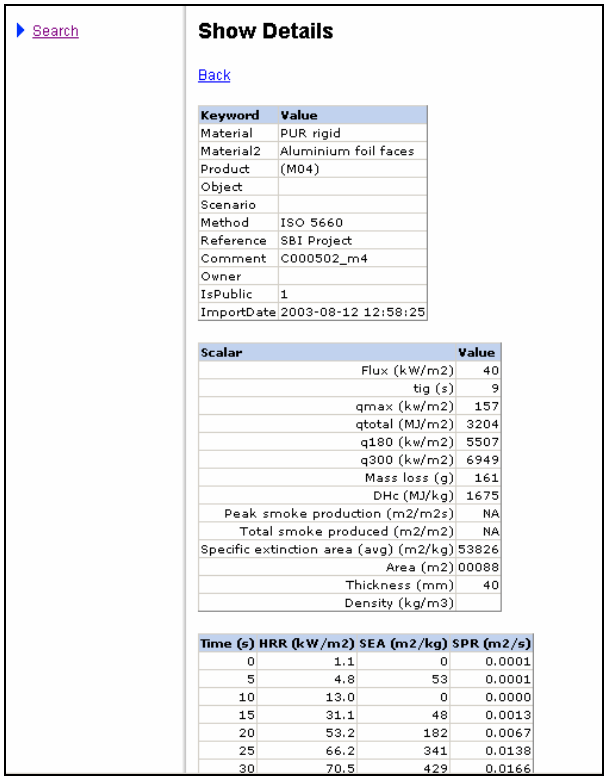


ImportID	Material	Material2	Product	Object	Scenario	Method	Reference	Show	XML	Text	Graph
80	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
81	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
82	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
83	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
84	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
85	PUR rigid	Plastic faced steel sheet				ISO 5660	EUREFIC	Show	Export	Export	Draw
253	FR PUR	Plasterboard	(M27)			ISO 5660	SBI Project	Show	Export	Export	Draw
256	PUR rigid	Aluminium foil faces	(M04)			ISO 5660	SBI Project	Show	Export	Export	Draw
257	PUR rigid	Aluminium foil faces	(M04)			ISO 5660	SBI Project	Show	Export	Export	Draw
259	FR PUR rigid	Plasterboard	(M27)			ISO 5660	SBI Project	Show	Export	Export	Draw

Figure 11. Example of search result

A.2.5 Show

Clicking Show will display the complete data set with scalars and vector values. Empty scalar fields or scalar fields containing NA means that this value was not available at the import stage, or that it is not relevant. See also Draw below.



Keyword	Value
Material	PUR rigid
Material2	Aluminium foil faces
Product	(M04)
Object	
Scenario	
Method	ISO 5660
Reference	SBI Project
Comment	C000502_m4
Owner	
IsPublic	1
ImportDate	2003-08-12 12:58:25

Scalar	Value
Flux (kW/m2)	40
tig (s)	9
qmax (kw/m2)	157
qtotal (MJ/m2)	3204
q180 (kw/m2)	5507
q300 (kw/m2)	6949
Mass loss (g)	161
DHc (MJ/kg)	1675
Peak smoke production (m2/m2s)	NA
Total smoke produced (m2/m2)	NA
Specific extinction area (avg) (m2/kg)	53826
Area (m2)	00088
Thickness (mm)	40
Density (kg/m3)	

Time (s)	HRR (kW/m2)	SEA (m2/kg)	SPR (m2/s)
0	1.1	0	0.0001
5	4.8	53	0.0001
10	13.0	0	0.0000
15	31.1	48	0.0013
20	53.2	182	0.0067
25	66.2	341	0.0138
30	70.5	429	0.0166

Figure 12. Example of a search result displayed (limited view, vector data continues).

A.2.6 Export

The export function can be used to export a data file into two different formats, Text or XML. The Text option will produce a ASCII text file with semi-colon separation that can be opened in any text editor or graph program. The XML (Extensible Markup Language) option exports a file in the XML format, which can be opened in most modern softwares, like Microsoft Office 2003 and later. When clicking Export a file dialog will appear prompting a location for the file. Click Save and choose a location. Close the window afterwards.

A.2.7 Draw

The Draw function opens a new window allowing you to display the vector data as graphs in a convenient and quick way. An example graph is shown in Figure 13. Below the graph is a drop-down list where you can choose what variable to plot, in the example case there are two smoke parameters available, SPR and SEA.

To print or save the graph simply right-click on the graph and choose Print. Close the graph window to go back to the search page.

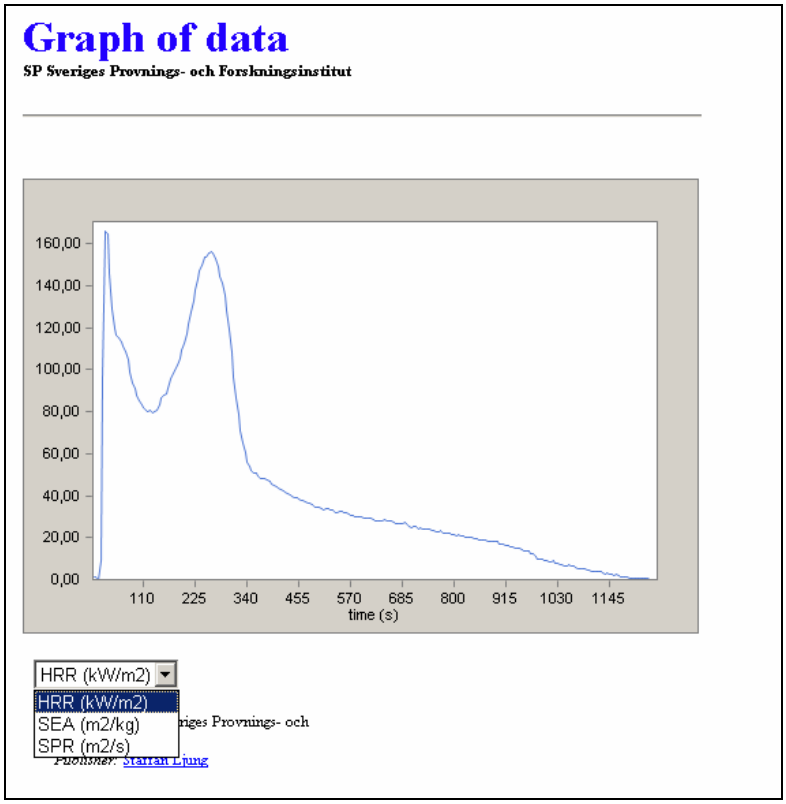


Figure 13. Example plot of a Cone Calorimeter result.

A.3 Register for use

In order to access the data base a user has to register with name, address and email. After submission an email will be sent containing username and password for access. All user information submitted will be handled confidentially. Note that you cannot reply to the password email, for contact information see section 0 below.

A.4 Contribute to the Fire Data base

The data base is so far free to use for anyone and contains mostly published data. If you have data from a fire test that you would like to share with the fire community we would be very grateful if you could provide us with this and help expand the data base. We do however no guarantee that the data will be imported into the data base. It is also possible to sponsor specific projects for data import, see below. Any well-defined data is of interest as long as it is in ASCII format and is described as shown below. See also the <Search> page.

Data requirements for each individual test:

- Keywords as described in <Search>. This is essential.
- Scalars defining the material, i.e thickness and density.
- Any derived scalars depending on what kind of test it concerns, i.e Peak HRR, Total HRR, see also <search>.
- ASCII text file with the data in columns, one of which must be the test time in seconds. Each column should have a header and there may be more columns in the file than what is imported. State which columns you would like to register in

the data base, i.e HRR and SPR. The separator used in the ASCII files can be semi-colon, comma, space, tab or other.
- Reference to the source of the data.

If some of the data is missing these fields will simply be empty in the data base.

A.5 Sponsor the Data base

If you have used the data base and it has been of help you are very welcome to sponsor the development. It is also possible to sponsor a specific project, e.g. if you are interested in importing and publishing data from a specific material or product. Contact SP Fire Technology if this is of interest.

A.6 Contact

For further info, queries or comments please contact:

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