APPENDIX A

EROSION DATABASE. USER'S GUIDE

(by J.Steller and M.Klein)

A1. GENERAL

The ICET database has been developed as an application of the *Microsoft Access*™ *v.2.0* software using the *Microsoft Access Developer's Toolkit 2*. The main purpose of the database is to allow easy access to most of the source data delivered by the ICET Contributors. It is expected that such an access will facilitate independent interpretation and free discussion of the ICET results. There exists also a possibility to extend the database by additional data or to use its structure for the needs of other round robin tests.

The current version of the ICET database comprises main data on contributing labs and test facilities involved, chemical composition and mechanical properties of test materials as well as erosion test results available both in form of exportable tables and volume loss versus time curves. The installation files are available at the ICET Co-ordinator's at 3.5" diskettes and at the IMP PAN host computer under the *http://www.imp.gda.pl/icet* address.

Guides to the subsequent versions will be distributed together with the installation files.

The database is delivered "as it is". The author[1] takes no legal responsibility, for any problems, as well as explicit or implicit defects, having occurred when running this software. Although the software has been developed very carefully, the author does not feel himself able to guarantee lack of any errors.

The database may be thrown open to all potential users provided no fees are taken and no modifications are introduced without consent of the author or the ICET Co-ordinator.

A2. INSTALLATION

The ICET database can be installed at any IBM PC compatible computer fulfilling the following requirements

1. processor 80486/66 or better,
2. hard disk with at least 10 Megabytes (MB) of free space,
3. Microsoft mouse or another mouse compatible pointing device (absolutely needed),
4. VGA or other compatible graphics adapter
   (SVGA or better adapters are recommended),
5. Microsoft Windows ver.3.1, MS Windows for Workgroups ver.3.11,
   MS Windows NT, MS Windows 95 or 98 software environment.

[1] Marek Klein, currently: ZRE Gdańsk Sp. z O.O., ul. Litewska 14a, 80-718 Gdańsk, Poland

In order to install **the database from the diskettes** attached to this Report please insert disk no. 1 into your floppy disk drive and run the *setup.exe* file. Insert subsequent disks as requested and follow other instructions and messages displayed.

Alternatively, you can also create installation directories (*DISK1, ..., DISK6*) at your default hard disk drive (C:\) and copy contents of installation disks into relevant installation disks. Now you can install the database by running the *setup.exe* file from the *DISK1* directory

In order to install **the database from the ICET *www* page** using the *erosion.exe* installation file please proceed as follows

1. Create a temporary directory, e.g. *C:\TEMP*, at the hard disk of your computer.
2. Using any *www* page viewer copy the *erosion.exe* file to the created directory.
3. Run the *erosion.exe* self-unpacking file
4. Run the *setup.exe* installation file in the Windows environment. Please follow the instructions and messages displayed.
5. After successful installation, you can erase your temporary directory.

In order to install **the database from the ICET *www* page** using the *disk1.exe, ..., disk6.exe* installation files please proceed as follows

1. Create temporary directories *DISK1, ..., DISK6* at your default hard disk.
2. Using any *www* page viewer copy the *disk1.exe, ..., disk6.exe* files to the relevant *DISK1, ..., DISK6* directories.
3. Run all the mentioned files in order to unpack their contents into the temporary directories
4. Run the *setup.exe* installation file (*DISK1* directory) in the Windows environment. (Please, follow the instructions and messages displayed.)

Alternatively, you can also copy the contents of (*DISK1, ..., DISK6*) directories to floppy disks and use them as installation disks.

After successful installation, the database folder should comprise the following files:

- the start-up executable files (*.exe* extension),
- some libraries of the MS Access system (*.DLL* extension),
- three data files (*.MDB* extension).

You can start now the executable file in order to check the installation and erase your temporary directory, if any.

A3. DATA ACCESS PRINCIPLES

A3.1 General

Data can be accessed both in the *View* and *Edit* mode. The *View* mode is default. The modes can be set using the *Option* dialogue box available by selecting the *Global/Option* sequence from the menu bar or *Option* button from the main Control Panel (Fig.A1). Fast swapping between the modes is possible using the *F2* key. Access to the *Edit* mode is protected by the *EROSION* password. Due to possible errors, we strongly recommend to make a copy of all the data files prior to entering this mode.

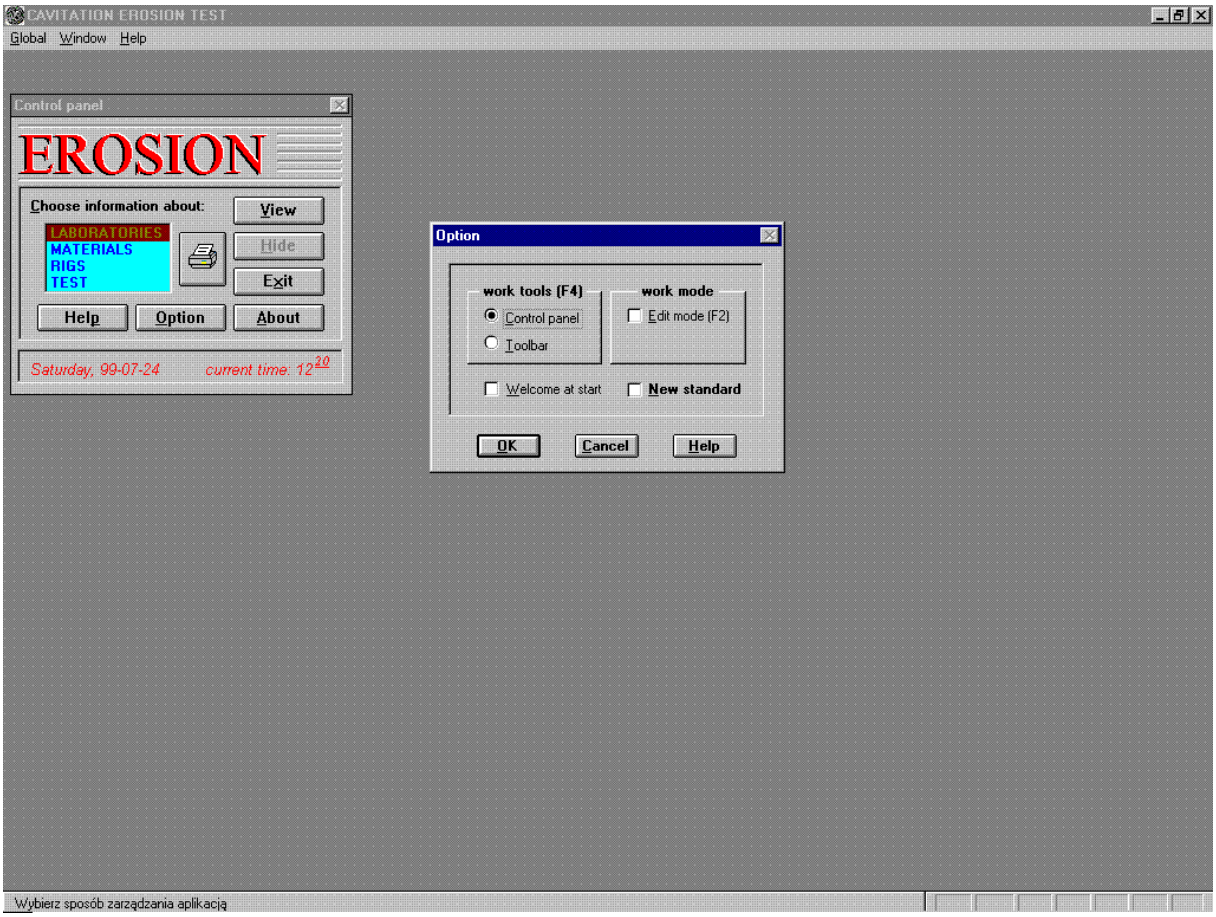


Fig.A1 ICET database desktop with the *Control Panel* and *Options* dialogue boxes.

A3.2 *Edit* Mode

In this mode you can insert or delete records and edit the data fields. Access to the records is obtained by selecting one of main objects from the *Control Panel* or the Toolbar. The *n/d* (no data) symbol is displayed in red inside all empty fields.

Creating new records and entering the existing ones is possible by means of buttons. Please swap to the *View* mode in order to use the filtering mechanism.

You can copy, cut and paste marked portions of the data using *Edit* commands appearing in your menu bar. We recommend applying this mechanism for tabulated mass loss data

only. Exchange of data with other MS Windows applications is accomplished by means of the same tools.

Please take care of keeping our data compact at the end of the *Edit* mode session by selecting the *Global/Compact* sequence from the menu bar.

A3.3 *View* Mode

In this mode you can view all the data available in the database. Please select one of the main objects from the *Control Panel* or the *Toolbar* in order to get access to the records and data fields. Empty fields are invisible. Specified records and lists are accessed using navigation buttons and combo boxes. Editing of records in this mode is not possible.

A3.4 Reports

Reports can be generated from the *Control Panel* and *object* form level by pressing the "printer" button (Fig.A1). *Detailed* and *abridged* options are accessible from desktop tool bar (Fig.A2). By selecting the "printer" button from the toolbar, you can send the report to your printer. Abridged option is default when selected from the Control Panel level.[1]

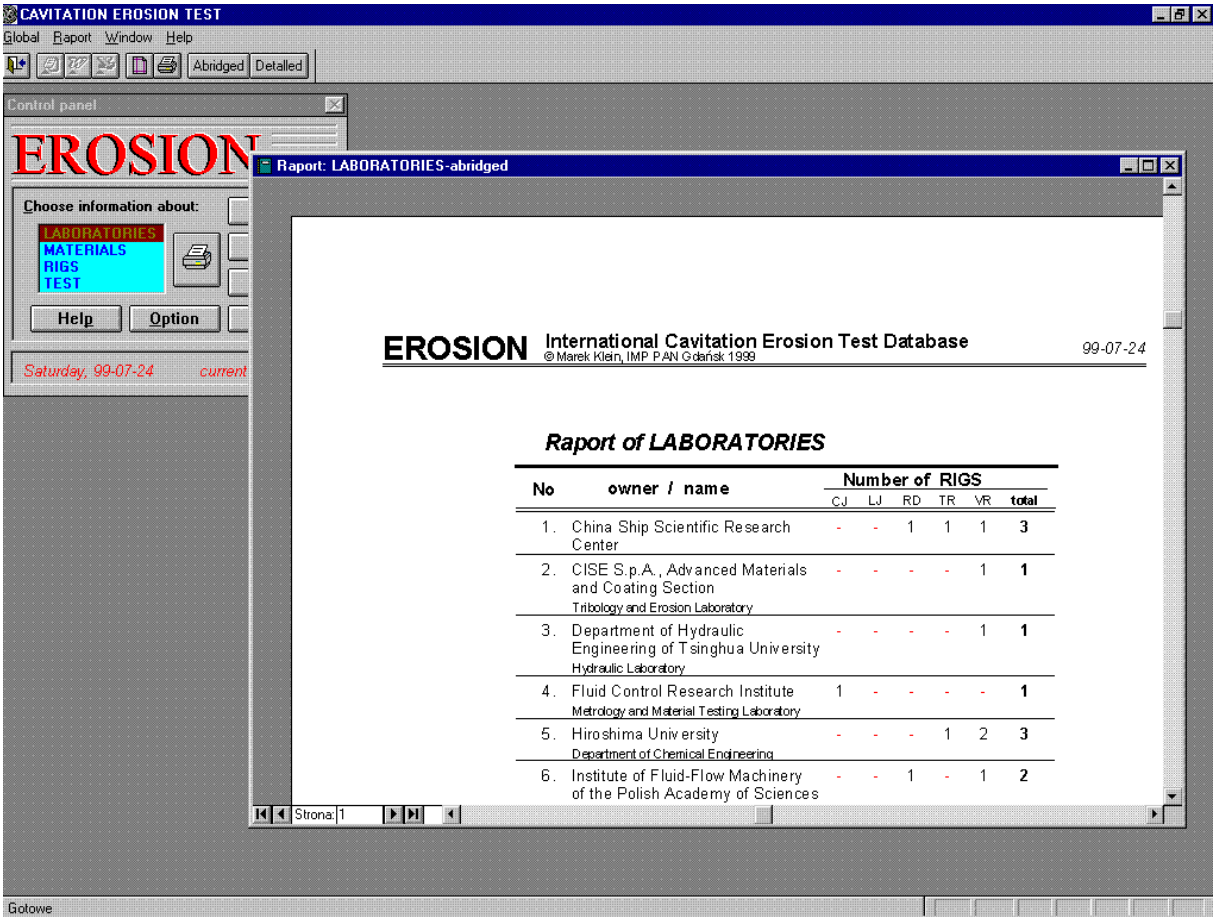


Fig.A2 ICET database desktop with an abridged Laboratory Report window

[1] The present version of the database generates only the reports covering the data on the ICET Participants.

A4. NAVIGATION PRINCIPLES

A4.1 General

Navigation through the database contents is accomplished using the following control tools:

- Control Panel
- toolbars
- buttons
- combo boxes

Navigation from the desktop level is conducted by means of the Control Panel or the Main Toolbar. You can select between these two tools using the *Options* dialogue box (Fig.A1)

A4.2 Control Panel

The Control panel window is visible within the main field of EROSION database if the *Control panel* option from Work tools controls group of Option window is selected.

This is the main tool (in parallel with the Main Toolbar) that can be used to pass across application objects. It enables also to open and close object forms. Buttons within the Control panel window permit *printing reports*, call windows with options set-up and some other functions.

Appearance and contents of this window as well as access to some of its components depend on the context of current operations. Mainly, it depends on opening/closing of the objects1, current set-up of the *Global Options* etc. For example, during opening of one of the object forms the *View* or *Edit* button may get obscure and inaccessible. At the same time the *Hide* button is highlighted and accessible.

A4.5 Toolbars

In some cases you may wish to have more empty desktop space at your disposal. Using the Main Toolbar (to be selected by the toolbar option in the *Options* dialogue box) you can generate lists of records to be viewed or edited in the same way as when using the *Control panel.* A toolbar is also the main control tool when viewing and printing reports (Fig.A3)

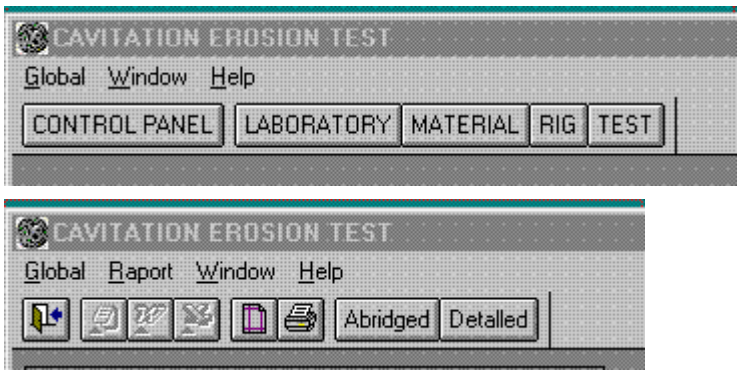


Fig.A3 Main and Report toolbars

A4.6 Buttons

Buttons are the main control tools when working with the forms and subforms. A list of buttons used with their brief description is given below.

	Command	***Additional description***
	Go to the first record:	Inactive in objects with less then 3 records.
	Go to the last record:	Inactive in objects with less then 3 records
	Go to the previous record:	Inactive in objects with a single record.
	Go to the next record:	Inactive in objects with a single record
	Create a new record:	Visible only in the *Edit* mode.
	Erase the displayed record:	Visible only in the *Edit* mode.
	Display all the records:	Visible only after previous filtering of the displayed records.
	Accept:	Updates related tables after editing the records (valid for the *TEST* object).
	Close:	Closes the current object form.
	Open the diagram:	Graphical representation of test results. Button blocked in case of no results available.
	Open the table:	Numerical (tabular) representation of test results. Button blocked in case of no results available
	Open the photograph:	*View* mode: button blocked if no *.jpg file is linked to the current record *Edit mode:* dialogue box enabling to link the current record with a *.jpg file
	Create/print the report	In the current version only reports on participating labs are accessible

A4.7 Combo Boxes

Combo boxes (expandable scroll boxes) are used in the *View mode* to create a list of records featured by the selected attribute (e.g. list of rigs of specified type, list of the rigs in specified lab, or the rig of specified type in the specified lab). The user is informed about results of the *filtering* process by the consecutive number of the focused item and the length of the list. In some cases combo boxes can be also used to select a record to be viewed. In general, please use navigation buttons (first, last, next and previous) for this purpose.

When in *Edit mode*, you can use a combo box to assign a new attribute to the focused record. In some cases attributes may be selected only from the displayed list, in some other cases you are expected to enter new ones. Please use navigation or swap to the View mode to access other records. An attempt to use *filtering* mechanism under *Edit mode* may result in an undesired change of attributes of the currently focused record.

A5. MAIN OBJECTS

A5.1 General

The basic components of the database are the following main objects to be selected from the main *Control panel* or *Toolbar*:

- *Labs*
- *Materials*
- *Rigs*
- *Tests*

Each of these *objects* is represented by a respective form displayed on the screen after opening. The forms contain numerical or text fields with description, navigation buttons between records, buttons for editing the contents of records if allowed, and a few other utility controls.

The appearance of and access to the components of a record depends on the current *working mode* of the application. Generally it is mutable in *View* or *Edit mode*. By selecting the Global/Compact sequence you'll take care of keeping your data compact after the last *Edit* mode session.

In general, only one *object* can be opened using the Control Panel or the Main ToolBar. However, you can access sub-forms of some related objects by clicking twice a suitable field (usually a *combo box* or a *list box* item with a black foreground on a grey-silver background). Closing a parent object causes closing all the child forms.

Generally, you are not able to view more than one form of an *object* at the same time.

A5.2 Labs

The object form (Fig.A4) contains main data on a participating lab.

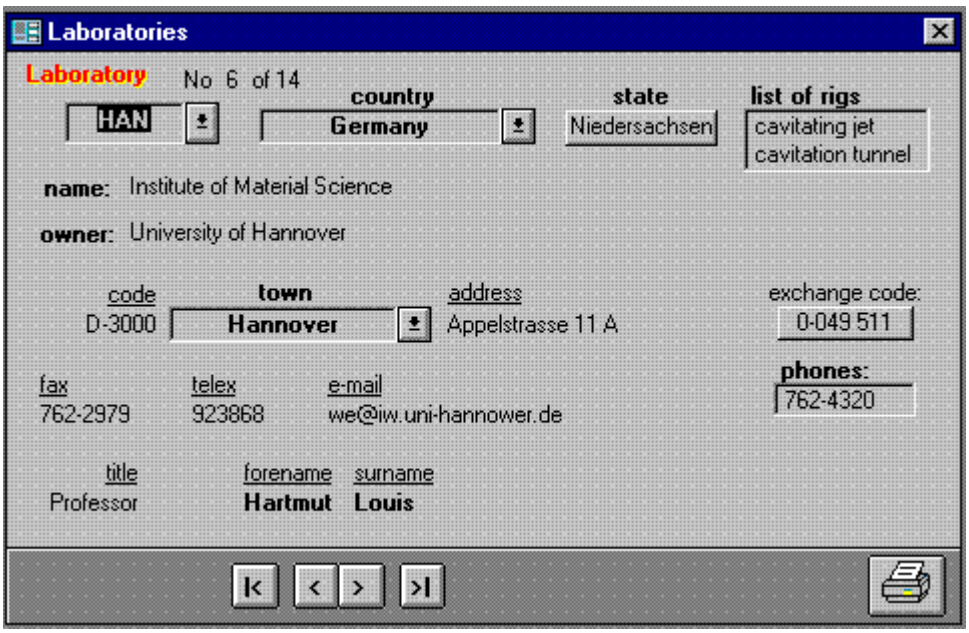


Fig.A4 View of a Lab form

The following data can be stored in each record

- Identification data
  1) Lab identifier
     (maximum 6 signs, e.g. FCRI for the lab in the Fluid Control Research Institute, India)
  2) Full name of the laboratory (e.g. Metrology and Material Testing Laboratory)
- Affiliation
  3) Full name of the affiliating institution (lab owner)
  4) Country
  5) State or province in the country
  6) Zip code
  7) Town
  8) Detailed address
  9) Fax, telex, phone numbers
- Personal data of the Test Contributor
  10) Scientific degree or professional title
  11) Full name
  12) E-mail address
  13) Phone number extension (if applicable)
- Additional data
  14) List of rigs taking part in the Test

When in *View* mode, you can access data on rigs in the list displayed by clicking twice the appropriate item. Pressing the „printer" button creates a detailed report on the particular lab.

A5.3 Rigs

A5.3.1 General

Each record consists of 3 segments: *identification data, general features and parameters and special features and parameter*s. The structure and contents of the last record depend essentially on the rig type stored in *the identification data* segment. List of all data fields is given below

Data fields

- Identification data
  1) Rig type (cavitating jet, liquid jet, cavitation tunnel, rotating disk, vibratory rig)
  2) Laboratory identifier
  3) Full name of the rig designer
  4) Full name of the rig manufacturer
  5) Comments on special features (if needed)

- General features and parameters

6) Test liquid (distilled or tap water)
7) Exposed surface area of a specimen, mm2
8) Standard test temperature, °C

- Special features and parameters (vibratory rig)

9) Specimen type (stationary, oscillating)
10) Input power, W
11) Horn tip frequency, kHz
12) Peak-to-peak amplitude, μm
13) Specimen submergence, mm
14) Horn tip/specimen gap, mm, (only in case of stationary specimen)
15) Beaker diameter, mm
16) Beaker height, mm

- Special features and parameters (rotating disk)

17) Cavitator type (hole, bolt)
18) Specimen type (stationary, rotating)
19) Disk diameter, mm
20) Cavitator diameter, mm
21) Cavitator mounting diameter, mm
22) Main engine power, kW
23) Rotation speed, rpm.
24) Mean pressure in the test chamber, kPa

- Special features and parameters (cavitation tunnel)

25) Cavitator type (wedge, bolt, barricade system)
26) Geometrical parameters of the cavitator (wedge)
    - Width, mm
    - Height, mm
27) Geometrical parameters of the cavitator (bolt)
    - Diameter, mm
    - Height, mm
28) Geometrical parameters of the cavitator (barricade system)
    - Slot width, mm

29) Test chamber cross section
    - Width, mm
    - Height, mm
30) Inlet pressure, kPa
31) Outlet pressure, kPa
32) Main pump power, kW
33) Flow rate, l/s

- Special features and parameters (cavitating jet cell)

34) Pump power, kW
35) Size of the chamber, mm
36) Upstream pressure, MPa
37) Downstream pressure, MPa
38) Nozzle diameter, mm
39) Nozzle length, mm
40) Stand-off distance, mm

- Special features and parameters (liquid jet facility)

41) Wheel diameter, mm
42) Rotation speed, r.p.m.
43) Jet velocity (absolute value), m/s
44) Nozzle diameter, mm
45) Stand-off distance, mm

A5.3.2 Special functions (View mode)

In order to access data on the tests conducted on the currently displayed rig, please click twice the *rig type* field.

In order to access data on the lab in which the currently displayed rig is located, please click twice the *laboratory* field.

A5.4 Materials

A5.4.1 General

The object is used to store data on the materials used in the Test programme. The structure of the record depends on the type of material stored in the *identification data* and *type of alloy* segments. The view of a typical ferrous alloy form is shown in Fig.A5 while the list of data fields is given below.

A5.4.2 Data fields

- Identification data
  1) Commercial name
  2) Full name
  3) Type of material (metal, polymer plastics, other)
- Type of alloy (metals)
  4) Ferrous
  5) Non-ferrous
- Physical properties (metals)
  6) Density, kg/m3
  7) Hardness, HV10
  8) Tensile strength, MPa
  9) Yield point, MPa
  10) Modulus of elasticity, GPa
  11) Ultimate strain, %
  12) Cross section reduction at fraction, %
- Physical properties (polymer plastics)
  13) Density, kg/m3
  14) Hardness, kG/mm2
  15) Relative viscosity of the monomer, %
  16) Relative viscosity of the solution, %
  17) Vicat softening temperature, °C
- Chemical composition (ferrous alloys), %
  18) Carbon, C
  19) Manganese, Mn
  20) Silicon, Si
  21) Phosphor, P

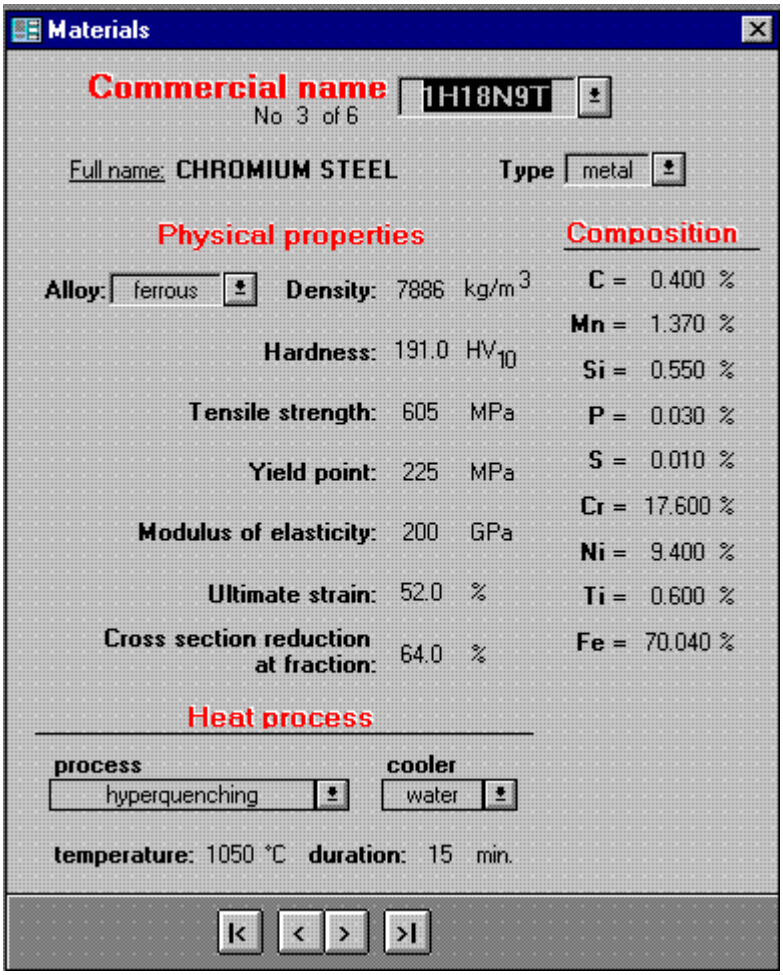
22) Sulphur, S

23) Chromium, Cr

24) Nickel, Ni

25) Titanium, Ti

26) Iron, Fe



- Chemical composition (non-ferrous alloys), %

27) Copper, Cu

28) Aluminium, Al

29) Zinc, Zn

30) Magnesium, Mg

- Heat processing parameters (metals)

31) Heat process description

32) Cooler

33) Temperature, °C

34) Duration, min

Fig.A5 View of a typical ferrous alloy form

A5.5 Test series

A5.5.1 General

Records displayed by this object describe a series of tests conducted on a specified series of materials under specified test conditions. Each series is identified by the test rig type, lab identifier and the set of test parameters. Filtering of rigs and labs lists is accomplished using the respective combo boxes (Fig.A6). Please, remember to use navigation buttons (first, last, next and previous) to select a record to be viewed.

Tests in a series are identified by test materials. Sub-records corresponding to individual tests and specimens are created, entered, edited and erased using navigation buttons, combo boxes and other typical MS Windows techniques. The contents of the individual records are described in the further subsections.

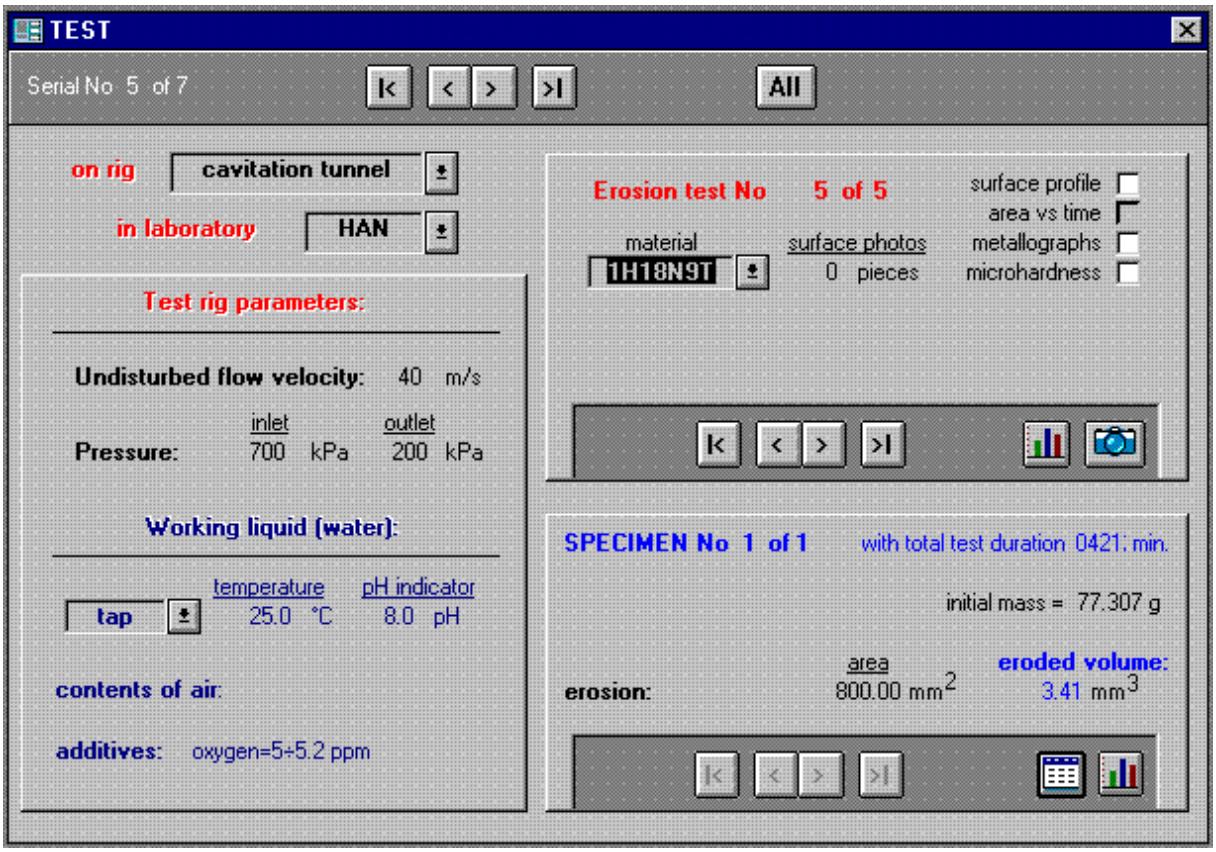


Fig.A6 View of a typical test series form

A5.5.2 Test series record

- Identification data
  1) Lab identifier
  2) Rig type
- Test series parameters
- Working liquid properties
- Test documentation
- Test run (specimen) data

Special functions

When in *View* mode, click twice the lab identifier in order to open the respective *laboratory* form. Clicking twice the *rig type* will open the respective *Rig* form. Further special functions are available through the *Test documentation* and *Specimen* sub-forms.

A5.5.3 Test series parameters

The contents of this sub-record depend on the kind of test rig applied.

Data fields

Vibratory rig:

1) Vibration frequency, kHz
2) Peak-to-peak amplitude, μm

Rotating disk

3) Peripheral velocity of the cavitator, m/s
4) Mean pressure in the test chamber, kPa

Cavitation tunnel

5) Undisturbed flow velocity, m/s
6) Upstream (inlet) pressure[1], kPa
7) Downstream (outlet) pressure, kPa

Cavitating jet cell

8) Nozzle diameter, mm
9) Liquid velocity, m/s
10) Upstream pressure, kPa
11) Downstream pressure, kPa

[1] All pressures are given in absolute units

Liquid jet facility

12) Peripheral velocity of the specimens, m/s
13) Jet velocity (in the lab frame of reference), m/s
14) Jet diameter, mm

A5.5.4 Working liquid properties

Data fields

1) Kind of liquid (water) applied, tap/distilled
2) Temperature, °C
3) pH indicator
4) contents of dissolved air
5) contents of undissolved air
6) other chemical additives

A5.5.5 Test documentation

This sub-record informs on available documentation of a test conducted on a specified material under specified test conditions.

Data fields

1) Commercial name (identifier) of the test material
2) Comment (text)
3) Number of available surface photographs

logical data on documentation contents

4) Surface profiles (yes/no)
5) Eroded area vs time curves (yes/no)
6) Metallographs (yes/no)
7) Microhardness distribution (yes/no)

Special functions

When in *View* mode, click twice the test material identifier in order to open the respective test material form.

In order to display the respective set of erosion curves (Fig.A7), please click the *diagram* button and select the kind of diagram from the toolbar. You can close the diagram by clicking the *diagram* button again or clicking twice any point of the diagram window.

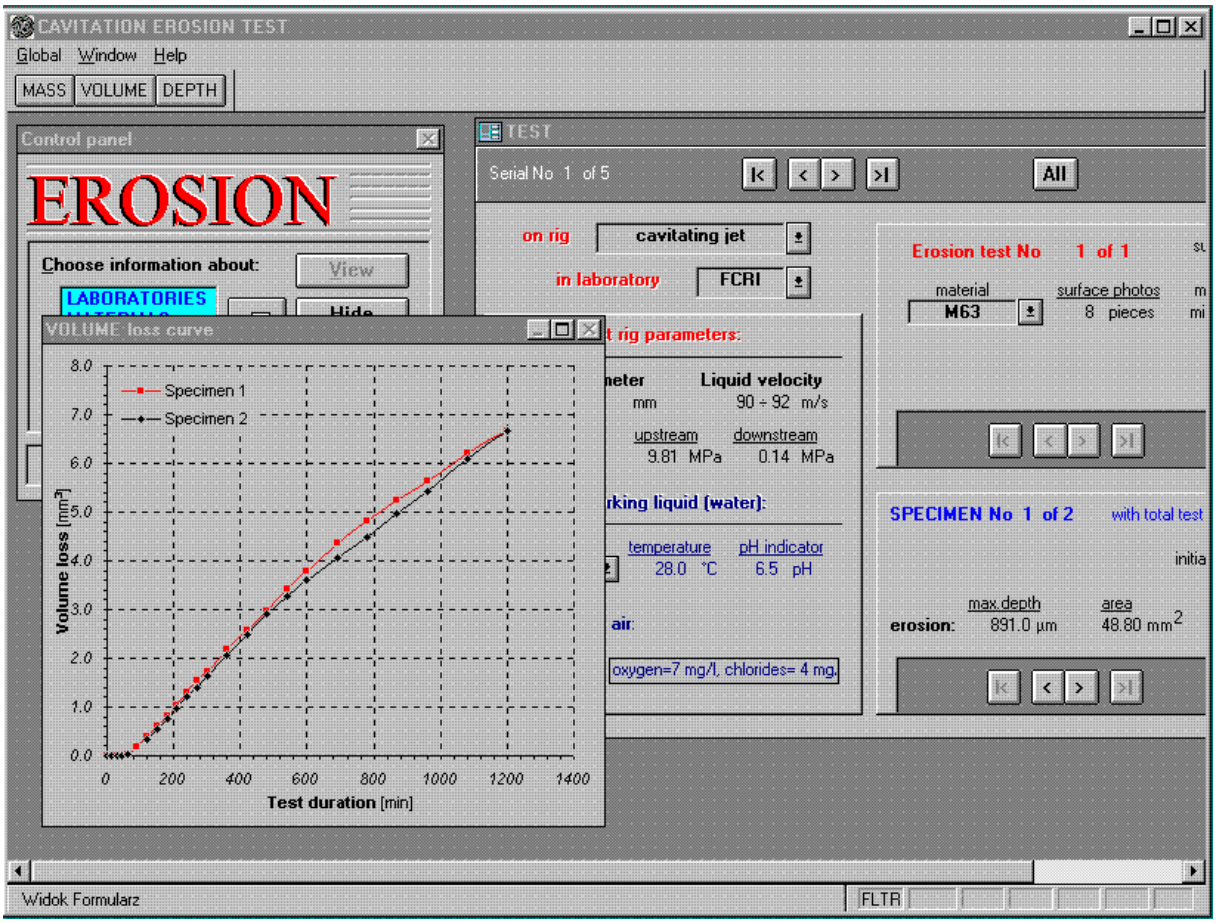


Fig.A7 Database window with a set of volume loss curves and the diagram toolbar

A5.5.6 Test run (specimen) data

This sub-record describes results of a test conducted on a specified test material specimen under specified test conditions

Data fields

1) Date of the test protocol
2) Total test duration
3) Initial mass of the specimen
4) Maximum depth of erosion
5) Eroded area
6) Eroded volume (calculated from the total mass loss and the density of material tested)

Special functions

In order to view or edit the mass loss course, please click the *table* button in the bottom tool-bar of the *specimen* subview. Closing of the table window (Fig.A8) is accomplished by a standard button in the upper right corner of the window. The volume loss is calculated auto-matically using the density of eroded material. The mean depth of penetration parameter will be calculated providing that the *eroded area* parameter has been entered.

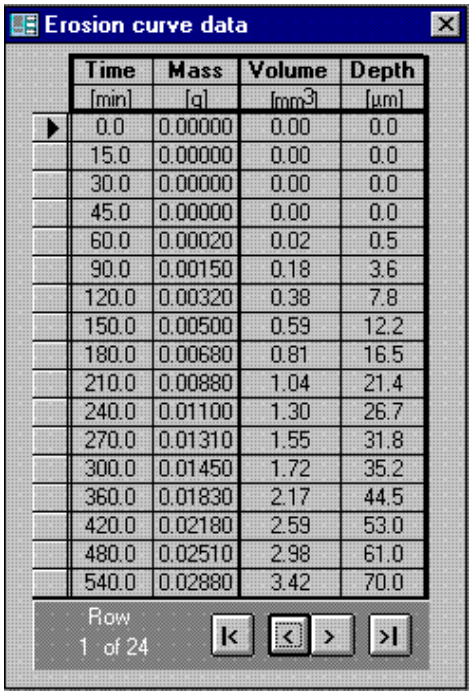


Fig.A8 A mass loss table

When in *Edit* mode, please remember that the tool-bar of a newly initialised *specimen* form is inactive until you have entered any of the data fields. Editing of the mass loss table is very simple. You can cut, copy and paste marked portions of the data using *Edit* commands appearing in the main menu bar. Exchange of data with other MS Windows applications is accomplished in a standard way.

In order to view the *volume loss curve* of the current specimen, please click the *diagram* button. You can easily change to mass loss or mean depth of penetration curve by selecting appropriate item from the auxiliary menu bar. Please, use the standard button in order to maximise the diagram to full screen. In order to close the diagram, please click twice any point in the diagram area.

APPENDIX B

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