

# **ENDF Utility Codes Release 7.01/02**

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Release 7.01- April 27, 2005

Release 7.02 (FIZCON & PSYCHE only) – May 31, 2005

The present release of the ENDF utility codes, version 7.01/02, supersedes all previous versions of the codes and this document supersedes all previous documentation. The programs are written to process ENDF-6 formatted files including all formats approved up to and including the November 2004 CSEWG meeting except for the Generalized R-Matrix resonance region format and the generalized format for covariances (file 30) and the new “trial” formats for resonance parameters and their covariances. The programs will also process ENDF-5 formatted files.

The distributed version of the programs, STANEF, CHECKR, FIZCON, PSYCHE, and INTER have been updated for format changes and modified to conform with the requirements of the Modlib Project of the NEA Working Party on International Evaluation Cooperation. The GETMAT, LISTEF, and PLOTEF programs are no longer supported.

The original codes were designed for batch mode operation. Input records consist of free format data fields with each field except the last delimited by a comma. Each program can process more than one input file (ENDF tape) per run with the user supplying the input file specifications appropriate to his computer. Standard processing options can be selected by specifying a completely blank option specification record. The only interactive input required is the name of the batch mode input file.

In addition to the batch mode each program can be run interactively. The codes prompt the user for each piece of input data instead of reading it from an input file. The input and output file specifications may be entered on the command line separated by a percent sign (%). An optional third parameter specifies whether or not to use default values for the other run parameters. If defaults are not used, then the remaining run parameters must be entered interactively.

A small computer program, SETMDC is used to convert the provided source code from one platform version to another. The batch mode version (provided on the web site) is indicated by “ANS” code, the interactive versions by “VMS”, “WIN” and “UNX”.

## List of Codes in the ENDF 7.0 Utility Package

STANEF	—	Creates directory, adds tape label and converts numeric fields Converts to binary format
CHECKR	—	Format checking program
FIZCON	—	Procedures and simple physics checking program
PSYCHE	—	More complicated physics checking program
INTER	—	Calculates selected cross sections and integrals

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## STANEF

STANEF is designed to perform bookkeeping operations on a data file containing one or more material evaluations in ENDF format. These operations include:

1. Creation or modification of a "tape ID" record,
2. Creation or update of the directory in MT=451,
3. Create or modify special hollerith ID records in MT=451 (ENDF-6 only),
4. Resequencing,
5. Conversion of integer and floating point fields to standard format,
6. Creation of a binary (ENDF alternate format) file.

### Fortran Logical Units Used:

5	—	Input
6	—	Output
20	—	Input data file, ENDF format
21	—	Output data file, ENDF format
22	—	Temporary storage

### Input Requirements:

In batch mode operation, the user must supply the following control information repeated for each input file to be processed.

RECORD 1	—	Input file specification
RECORD 2	—	Output file specification
RECORD 3	—	Tape label
FIELD 1	—	Tape label number (integer up to 4 digits) < 0 means tape has no label = 0 means copy old label (default) > 0 means the value is used as the tape label number
FIELD 2	—	Up to 66 character text for ENDF tape label
RECORD 4	—	Options selection (4 fields)
FIELD 1	—	Mode of output file (integer) 0 Character format output (default) 1 Binary format (fields 2 and 3 ignored)
FIELD 2	—	Update directory and special hollerith (character) Y execute this option (default) N do not execute this option

- FIELD 3 — Numeric field standardization (character)  
 Y execute this option (default)  
 N do not execute this option (default)
- FIELD 4 — Numeric field standardization for 2/151(character)  
 Y execute this option  
 N do not execute this option

If RECORD 4 is left entirely blank, then the “default” options are executed. Those are character format output file, update MT=451 and standardize numeric fields.

Multiple input files can be processed to produce multiple output files by repeating the above input data sequence. The program execution is terminated with a record containing the word DONE.

In interactive mode operation, the above data is supplied in response to the appropriate query; in graphical mode, via a dialog box.

**Sample Batch-mode Input:**

	<u>Record Type</u>
RAW.603	(1)
INDEX.603	(2)
0	(3)
0, Y, N	(4)
RAW.610	(1)
TAPE.610	(2)
610, ENDF/B-VI FISSION PRODUCT TAPE 2	(3)
(blank record)	(5) default
DONE	end of run

**Command Mode Operation:**

Under OpenVMS, the command, `SRANEF ::= $STANEF.EXE` must be defined. No environment definitions are required for Windows or Linux. Some of the input data may be given on the command line as follows:

`STANEF input_file %output_file %standard_options [Y OR N]`

If no input data is given on the command line, the program operates in the normal interactive mode. If no output file is given, the output file specification is assumed to be the same as the input file. Any tape label is copied unchanged. If non-standard options are selected, then the program prompts for each option in the usual way.

**CHECKR**

CHECKR is a program for checking that an evaluated data file conforms to the ENDF format. It can recognize the difference between ENDF-6 and ENDF-5 formats and performs its tests accordingly. Integer control fields are checked to see that ENDF/B procedural limits on those fields are not violated. To the extent possible, fatal format errors are trapped to prevent unwanted termination of the program. Any file that passes through CHECKR without error messages fully conforms to the ENDF format. CHECKR will now operate on a file, which has not been processed with STANEF. This has been done to facilitate processing by eliminating error messages in CHECKR, which would be automatically fixed by STANEF, which requires that the input file be in legal ENDF format.

### Fortran Logical Units Used:

5	—	Input
6	—	Output
20	—	Input data file, ENDF format
21	—	Message file for program checking results

### Input Requirements:

In batch mode operation, the user must supply the following control information repeated for each input file to be processed.

RECORD 1	—	Input file specification
RECORD 2	—	Message file specification
RECORD 3	—	Options selection (2 fields)
FIELD 1	—	Material number where processing starts (integer) (If zero or blank, then checking begins with the first material)
FIELD 2	—	Material number where processing ends (integer) (If zero or blank, then checking continues to end of the file)

If RECORD 3 is left entirely blank, then the entire input file is processed.

Multiple input files can be processed to produce multiple output files by repeating the above input data sequence. The program execution is terminated with a record containing the word DONE.

In interactive mode operation, the above data is supplied in response to the appropriate query; in graphical mode, via a dialog box.

### Sample Batch-mode Input:

	<u>Record Type</u>
TAPE .603	(1)
(blank record)	(2) output to unit 6
5200,5642	(3)
TAPE .610	(1)
CHECKR.610	(2)
(blank record) }	(3) default
DONE	end of run

### Command Mode Operation:

Under OpenVMS, the command, `CHECKR := $CHECKR.EXE` must be defined. No environment definitions are required for Windows or Linux. Some of the input data may be given on the command line as follows:

```
CHECKR input_file%output_file%standard_options [Y or N]
```

If no input data is given on the command line, the program operates in the normal interactive mode. If non-standard options are selected, then the program prompts for each option in the usual way.

## FIZCON

FIZCON is a program for checking that an evaluated data file has valid data and conforms to recommended procedures. It can recognize the difference between ENDF-6 and ENDF-5 formats and performs its tests accordingly. Some of the tests performed include

1. Data arrays are in increasing energy order,
2. Resonance parameter widths add up to the total,
3. Q-values are reasonable and consistent,
4. No required sections are missing and all cover the proper energy range,
5. Secondary distributions are normalized to 1.0,
6. Energy conservation in decay spectra.

Optional tests can be performed to check that redundant cross sections such as the inelastic cross section has an energy grid which is the union of all its components and the cross section values are the sum of the component values at each energy (SUMUP test). Also optionally, algorithms are used to check for possible incorrect entry of data values (Deviant Point test). It is assumed the file being checked has passed the CHECKR program without any errors being detected.

### Fortran Logical Units Used:

5	—	Input
6	—	Output
20	—	Input data file, ENDF format
21	—	Message file for program checking results
22 & 23	—	Temporary paging files for large data arrays
24 & 25	—	Temporary files for the SUMUP tests

### Input Requirements:

In batch mode operation, the user must supply the following control information repeated for each input file to be processed.

RECORD 1	—	Input file specification
RECORD 2	—	Message file specification (if blank, messages go to standard output file on unit 6)
RECORD 3	—	Options selection (5 fields)
FIELD 1	—	Material number where processing starts (integer) (If zero or blank, then checking begins with the first material)
FIELD 2	—	Material number where processing ends (integer) (If zero or blank, then checking continues to end of the file)



- FIELD 3 — Deviant point test control (character)  
 Y Do the test  
 N Do not do the test (default)
- FIELD 4 — SUMUP test control (character)  
 Y Do the test  
 N Do not do the test (default)
- FIELD 5 — Fractional acceptable difference (real)  
 The floating point number entered here represents the maximum fractional difference tolerated in an equality test such as a SUMUP test. The default value if none is entered is .001 (1/10 of a percent).

If RECORD 3 is left entirely blank, then the “default” options are executed. Those are to process the entire input file, to omit the SUMUP and Deviant Point tests and to assume an allowed fractional error of .001.

Multiple input files can be processed to produce multiple output files by repeating the above input data sequence. The program execution is terminated with a record containing the word DONE.

In interactive mode operation, the above data is supplied in response to the appropriate query; in graphical mode, via a dialog box.

### Sample Batch-mode Input:

	<u>Record Type</u>
TAPE . 603	(1)
(blank record)	(2) output to unit 6
5200 , 5642 , N , Y , . 002	(3)
TAPE . 610	(1)
FIZCON . 610	(2)
(blank record)	(3) default
DONE	end of run

### Command Mode Operation:

Under OpenVMS, the command, `FIZCON ::= $FIZCON.EXE` must be defined. No environment definitions are required for Windows or Linux. Some of the input data may be given on the command line as follows:

`FIZCON input_file%output_file%standard_options [Y or N]`

If no input data is given on the command line, the program operates in the normal interactive mode. If non-standard options are selected, then the program prompts for each option in the usual way.

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## PSYCHE

PSYCHE is a program for checking the physics content of an evaluated data file. It can recognize the difference between ENDF-6 and ENDF-5 formats and performs its tests accordingly. The present version checks for energy conservation for emitted particles, checks Wick's limit for elastic scattering, analyzes resonance parameter statistics, calculates thermal cross sections and resonance integrals, examines continuity across resonance region boundaries and checks "Q" values against mass tables. It is assumed the file being checked has passed the CHECKR program without any errors being detected.

### Fortran Logical Units Used:

5	—	Input
6	—	Output
20	—	Input data file, ENDF format
21	—	Message file for program checking results
22 - 25	—	Temporary files for energy conservation tests

### Input Requirements:

In batch mode operation, the user must supply the following control information repeated for each input file to be processed.

RECORD 1	—	Input file specification
RECORD 2	—	Message file specification (if blank, messages go to standard output file on unit 6)
RECORD 3	—	Options selection (2 fields)
FIELD 1	—	Material number where processing starts (integer) (If zero or blank, then checking begins with the first material)
FIELD 2	—	Material number where processing ends (integer) (If zero or blank, then checking continues to end of the file)

If RECORD 3 is left entirely blank, then the entire input file is processed.

Multiple input files can be processed to produce multiple output files by repeating the above input data sequence. The program execution is terminated with a record containing the word DONE.

In interactive mode operation, the above data is supplied in response to the appropriate query; in graphical mode, via a dialog box.

### Sample Batch-mode Input:

	<u>Record Type</u>
TAPE .603	(1)
(blank record)	(2) output to unit 6
5200,5642,	(3)
TAPE .610	(1)
PSYCHE .610	(2)
(blank record)	(3) default
DONE	end of run

### Command Mode Operation:

Under OpenVMS, the command, `PSYCHE := $PSYCHE.EXE` must be defined. No environment definitions are required for Windows or Linux. Some of the input data may be given on the command line as follows:

```
PSYCHE input_file%output_file%standard_options [Y or N]
```

If no input data is given on the command line, the program operates in the normal interactive mode. If non-standard options are selected, then the program prompts for each option in the usual way.

## INTER

INTER is a program for calculating thermal cross sections, g-factors, resonance integrals, fission spectrum averaged cross sections and 14.0 MeV (or other energy) cross sections for major reactions in an ENDF-6 or ENDF-5 format data file. To operate properly, the cross sections must be given pointwise in File 3 and have been linearized. Therefore evaluations containing resonance parameters must first be processed by a code such as RECENT to produce a complete pointwise data file and interpolation codes, which are not constant or linear-linear must be processed by a code such as LINEAR.

### Fortran Logical Units Used:

5	—	Input
6	—	Output
20	—	Input data file, ENDF format
21	—	Output file for program results

### Input Requirements:

In batch mode operation, the user must supply the following control information repeated for each input file to be processed.

RECORD 1	—	Input file specification
RECORD 2	—	Result file specification (if blank, output goes to standard output file on unit 6)
RECORD 3	—	Options selection (7 fields)
FIELD 1	—	Material number where processing starts (integer) (If zero or blank, then checking begins with the first material)
FIELD 2	—	Material number where processing ends (integer) (If zero or blank, then checking continues to end of the file)
FIELD 3	—	Thermal calculation control (character) Y Calculate thermal cross sections and g-factors (default) N Do not do the calculations
FIELD 4	—	Resonance integral calculation control (character) Y Calculate resonance integrals (default) N Do not do the calculations
FIELD 5	—	Fission spectrum calculation control (character) Y Calculate fission spectrum averages (default) N Do not do the calculation
FIELD 6	—	Single energy (real) The energy entered here in eV is used to calculate and list the cross sections at any single required energy. The default value is 14.0E+6 eV.
FIELD 7	—	Fractional error (real)

The floating point number entered here is the fractional error which will be tolerated when integrating between two points. The default value is .001.

If RECORD 3 is left entirely blank, then defaults for all values are assumed which are to process all materials, calculate both thermal cross sections and resonance integrals, calculate 14.0 MeV cross sections and allow a fractional error of .001. Neither of the following two records are required and the default parameters described below are assumed.

- RECORD 4 — Thermal calculation parameters (3 fields)  
(If thermal calculation is not done, omit this record)
- FIELD 1 — Thermal energy (real)  
The energy entered here in eV is used to calculate and list the Maxwellian averaged cross sections and g-factors. The default value is 0.0253 eV.
- FIELD 2 — Lower limit for Maxwellian integral(eV) (real) . The default is 1.0E-5 eV.
- FIELD 3 — Upper limit for Maxwellian integral(eV) (real) . The default is 10.eV.

If RECORD 4 is left entirely blank, then defaults for all values are assumed which are a thermal energy of 0.0253 eV and integration between .01 mV and 10.0 eV.

- RECORD 5 — Resonance integral calculation parameters (2 fields)  
(If resonance calculation is not done, omit this record)
- FIELD 1 — Lower limit for Resonance integral(eV) (real). The default is 0.5 eV.
- FIELD 2 — Upper limit for Resonance integral(eV) (real). The default is 100.0E+3 eV.

If RECORD 5 is left entirely blank, then defaults for all values are assumed which are integration between 0.5 eV and 100.0 keV.

- RECORD 6 — Fission spectrum calculation parameters (3 fields)  
(If fission spectrum calculation is not done, omit this record)
- FIELD 1 — Fission spectrum temperature(real)  
The temperature entered here is in eV and is used as the temperature in a Maxwellian distribution. The default value is 1.35E+6 eV.
- FIELD 2 — Lower limit for fission integral (eV) (real). The default is 1.0E+3 eV.
- FIELD 3 — Upper limit for fission integral (eV) (real). The default is 20.0E+6 eV.

If RECORD 6 is left entirely blank, then defaults for all values are assumed, which are a temperature of 1.35E+6 eV and integration between 1.0 keV and 20.0 MeV.

Multiple input files can be processed to produce multiple output files by repeating the above input data sequence. The program execution is terminated with a record containing the word DONE.

In interactive mode operation, the above data is supplied in response to the appropriate query; in graphical mode, via a dialog box.

**Sample Batch-mode Input:**

	<u>Record Type</u>
TAPE.639	(1)
VTOCU.INT	(2)
2300,2931,Y,Y,Y,14.+6,.001	(3)
(blank record)	(4) default
1.,100.+3	(5)
1.12E+6,1.E+3,20.E+6	(6)
TAPE.610	(1)
FISSPR.610	(2)
(blank record)	(3) default
DONE	end of run

**Command Mode Operation:**

Under OpenVMS, the command, INTER ::= \$INTER.EXE must be defined. No environment definitions are required for Windows or Linux. Some of the input data may be given on the command line as follows:

INTER *input\_file%output\_file%standard\_options* [Y or N]

If no input data is given on the command line, the program operates in the normal interactive mode. If non-standard options are selected, then the program prompts for each option in the usual way.



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