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EXFOR/CINDA Dictionary Manual

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Abstract: EXFOR is the exchange format for the transmission of experimental nuclear reaction data between national and international nuclear data centers for the benefit of nuclear data users in all countries. This report contains the description of the format and contents of the dictionaries of keywords, codes and abbreviations used in the EXFOR and CINDA systems.

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The IAEA-NDS-reports should not be considered as formal publications. When a nuclear data library is sent out by the IAEA Nuclear Data Section, it will be accompanied by an IAEA-NDS-report which should give the data user all necessary documentation on contents, format and origin of the data library.

IAEA-NDS-reports are updated whenever there is additional information of relevance to the users of the data library.

For citations care should be taken that credit is given to the author of the data library and/or to the data center which issued the data library. The editor of the IAEA-NDS-report is usually not the author of the data library.

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Citation guideline:

When quoting EXFOR data in a publication this should be done in the following way:

"A.B. Author et al.: Data file EXFOR-12345.002 dated 1980-04-05, compare J. Nucl. Phys. 12,345, (1979). EXFOR data retrieved from the IAEA Nuclear Data Section, Vienna."

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INTRODUCTION

The nuclear reaction data dictionaries contain the keywords and codes used by the Nuclear Reaction Data Center Network (NRDC) in the exchange and dissemination of nuclear reaction data and the associated bibliographic references. These dictionaries are central to the nuclear reaction database system with respect to compilation, checking, retrieval, plotting, conversion to computational formats, and most other applications. Therefore, their careful maintenance and the timely distribution of updates are essential tasks within the NRDC network.

The dictionaries are maintained by the Nuclear Data Section (NDS). All dictionary updates[1] are made on the NDS Master Archive, and are transmitted periodically to the other Nuclear Reaction Data Centers in one or more of the following forms: the complete Master Archive file, an EXFOR Dictionary transmission file, or a DANIEL backup file.

The formats of these files are described in this Manual. For certain applications (e.g. the EXFOR check program), additional, specially formatted versions of the dictionaries may be in use. These are produced automatically by special software from the standard dictionaries mentioned above, and are not described here.

This manual describes the format and contents of the dictionaries, as needed by compilers and software developers. As the dictionaries are maintained and updated only at NDS, the detailed updating procedures are not described here, but in an internal NDS document.

Also included in this manual is more detailed information for specific dictionaries of special interest.

The EXFOR dictionaries contain explanations for all keywords and codes used in CINDA and EXFOR. A **dictionary identification number** ranging between 1 and 999 is assigned to each dictionary.

Contents of the different dictionary forms

- The Archive dictionaries are the source of the contents of all forms of the dictionaries. They contain all coded information, code expansions, and flags, as well as free text explanations for compilers.

- The EXFOR transmission dictionaries (in a format similar to an EXFOR TRANS file) contain the codes, their expansions, and the free text explanations, but not all flags needed for the checking and other programs.

- The DANIEL backup dictionaries contain all codes and flags needed for programs, and most of the code expansions, but no free text explanations.

[1] See NRDC Protocol for dictionary updating procedures.

These different dictionary formats developed historically and were modified several times. Therefore, the numbers of some dictionaries changed, and some old versions of dictionaries are superseded (no longer used by standard EXFOR software and no longer updated), but are still kept in the system for some more time for backwards compatibility. See the **Table of Dictionaries** further below for a summary.

Dictionary distribution

The dictionaries are distributed in one or more of the following ways:

- in the NDS open area, subdirectory DICTS
- through the EXFOR backup web page http://www-nds.iaea.org/exfor-master/backup/

These distributions may also contain the latest version of the EXFOR check program CHEX with the correspondingly formatted dictionaries (ZVV). A program to generate these ZVV dictionaries from the DANIEL backup file for various computer platforms is also included in this distribution.

Chapter 1

DICTIONARIES GENERAL

1.1 Dictionary Contents

Each dictionary contains the following items of information:

1. Keyword or code: There are four keyword dictionaries; the remaining dictionaries define codes used within the BIB section under specific information-identifier keywords (see the 'Table of Dictionaries' below).

   The keyword dictionaries are:

Dict. 1	System identifiers (see EXFOR Systems Manual Chapter 2)	
Dict. 2	Information identifiers (see EXFOR Systems Manual Chapter 3)	
Dict. 24	Data headings	Used in COMMON and DATA sections (see EXFOR Systems Manual Chapter 4)
Dict. 25	Data units	

2. Expanded forms[2] are provided in certain dictionaries (see Table of Dictionaries), and are self-explanatory.

3. Free Text explanation of the keyword or code.

4. Other coded information is included for many of the dictionaries (*e.g.*, the country of origin for journal codes, certain flags for checking purposes in the case of data-heading keywords). For details see the dictionaries themselves, and the 'Table of Dictionaries' below.

Status of dictionary keywords or codes

The validity of a dictionary keyword or code may have expired or be restricted. This is indicated by an *Obsolete flag* (**OBS** or **O**) or an *Extinct flag* (**EXT** or **X**):

An **Obsolete flag** indicates that the keyword or code is not permitted on new transmissions, although it may still exist in entries that were transmitted previously. An explanation as to why the code is obsolete and which code (if any) replaces it may be given in free text. Obsolete codes remain in the dictionary until all cooperating centers have removed them from their data files.

An **Extinct flag** indicates that the given code designates an extinct institute, journal, or report series. The code is still valid on transmissions, but will occur only in entries of old data.

[2] The expanded form may be used to replace the code in an output format, so that the EXFOR user may read the entries without having to consult the dictionaries to find the meaning of the codes.

1.2 Table of Dictionaries

Dict. #	Name	Add'l info[3]	Code length	Expansion provided	Status [4]
***1**	System Identifiers		≤10		
***2**	Information Identifiers		≤10	yes	
3	Institutes	X	6 – 7	yes[5]	
***4**	Reference Type	X	1	yes	
5	Journals	X	≤6	yes	
6	Reports	X	≤11		
7	Conferences	X	≤10	yes	
8	Elements		≤6	yes	
(9)	Chemical Compounds		7 – 10	yes	*Cancelled, see Dict. 209*
10	Standard Reactions		≤2		*Not currently in use; only Archive and Daniel*
11	Forbidden Reactions (old CINDA)		≤4		*Not currently in use; only Archive and Daniel*
12	Old CINDA quantities		≤3		*Only Archive and Daniel; see Dict. 42 in TRANS*
13[6]	Reaction Type				*Only Archive and Daniel; Superseded by Dict. 213*
(13[6])	Particle (PART-DET, RAD-DET, *etc*)				*(TRANS only; Cancelled)*
14	Reaction Dimensions		1	yes	*Only Archive and Daniel*
15	History		1	yes	
16	Status	X	≤5	yes	
17	Related Reference		1	yes	
18	Facility		≤5	yes	
19	Incident Source		≤5	yes	
20	Additional Results		≤5	yes	
21	Method		≤5	yes	
22	Detectors		≤5	yes	
23	Analysis		≤5	yes	

[3] Additional information is given on the following pages.
[4] **Archive** = Archive dictionaries; **DANIEL** = DANIEL backup dictionaries; **TRANS** = EXFOR Transmission dictionaries. **Cancelled** = this dictionary is no longer included in distributions; it is listed here only for information (in case it is mentioned in older descriptions). **Superseded** = this dictionary is no longer updated and should not be used; it was replaced by another, up-to-date dictionary.
[5] Expansion may extend to follow-up records. In all other cases, expansion is restricted to the length of the explanation field of one record.
[6] Dictionaries with no. 13 were used for different purposes in TRANS dictionary and in the ARCHIVE/DANIEL dictionaries. Now, TRANS dictionary no. 13 is cancelled, and Archive/DANIEL dictionary no. 13 (Reaction Type) was replaced by dictionary no. 213 (also available in TRANS).

Dict. #	Name	Add'l info[3]	Code length	Expansion provided	Status [4]
***24**	Data Headings	X	≤10		
25	Data Units	X	≤10		
26	Unit Family codes				*Only Archive and Daniel*
27	Nuclides		≤10		Superseded by Dict. 227
(28)	Incident Particles (REACTION SF2)				*Cancelled*
(29)	Product Particles (REACTION SF3)				*Cancelled*
***30**	Process (REACTION SF3)		≤3		
***31**	Branch (REACTION SF5)		≤5[7]		
***32**	Parameter (REACTION SF6)		≤3		
***33**	Particles Considered (REACTION SF7)	X	≤3	yes	
***34**	Modifiers (REACTION SF8)	X	≤3		
***35**	Data Type (REACTION SF9)		≤5	yes	
36	Quantities (REACTION SF5-8)		≤44	yes	Superseded by Dict. 236
***37**	Result		≤5	yes	
42	Old CINDA Quantities		≤3		Only TRANS; corresponds to Archive /Daniel Dict. 12
43	NLIB for Evaluated Libraries		2		
44	Evaluated Library Reference Codes.		≤11		
45	CINDA Quantities		≤3		
47	Old/New CINDA Quantities		≤3		
48	Spectrum Averaged Energy Codes		≤5		
52	CINDA Reader Codes		1		
113	Web Quantities		≤3		
124	Data Headings (for plotting)		≤10		*Not currently in use; only Archive and Daniel*
125	Data Units (for plotting)		≤10		*Not currently in use; only Archive and Daniel*
136	Quantities (for plotting)		≤44		*Not currently in use; only Archive and Daniel*
144	Data Libraries for New CINDA		≤13		
207	Books	X	≤10	yes	
209	Chemical Compounds	X	7-10		
213	REACTION Types		≤4		
227	Nuclides	X	≤10	yes	

[7] Normally limited to a three-character code

235	Work type		1		
***236**	Quantities	X			
950	List of TRANS Dictionaries		3		Only TRANS

*Additions to these dictionaries require NRDC approval.

1.3 Additional Information on Specific Dictionaries

Remember that references to free text explanations refer to the Archive and TRANS dictionaries only.

Dictionary 3. Institute. The 7-character code ABBBCCC is constructed as follows:

A = service-area code, 1, 2, 3, or 4 as defined among neutron data centers (see EXFOR Systems Manual, page 1.4).
BBB = country code
CCC = lab code (may be less than 3 characters, left adjusted)

The 3-character institute codes include all laboratory, university, institute, agency and commission codes in use in the CINDA/EXFOR system, and must be unique.

Where the code identifies only a country, the information in the country-code field (columns 2-4) is repeated in the lab-code field (columns 5-7), as for example: 1CANCAN (Canada). For this reason, a lab code may not be identical to a country code.

For *obsolete* and *extinct* codes, the code that replaces it, if any, is given (in free text) in all cases. The dictionary is sorted by the code, thus grouping together the institutes for each area and country.

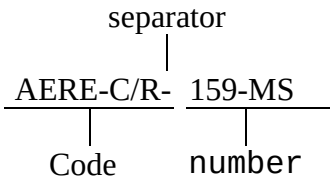
Dictionary 5. Journals. The actual journal code is restricted to 4 characters or less. Where journals are subdivided into parts, the part is included in the dictionary with the journal code, and separated from it by a slash; the complete code is restricted to 6 characters, as for example:

ND/A = Nuclear Data, Part A.

The expanded form follows the commonly adopted style for journal titles. However, some abbreviations have been expanded for clarity.

Dictionary 6. Reports[8]**.** The codes are 11 characters or less in length. Each code in the dictionary consists of the alphanumeric character string that precedes the actual report number. The final character of the codes given in the dictionary is always a hyphen (-), except in a few cases where the report codes are 11 characters; 12th character (not given in the dictionary) is a hyphen. Since the code and the number may both contain hyphens, the separator is defined as the first hyphen that is followed by a digit or an opening parenthesis, for example:

[8] Some older CINDA lines may use old CINDA codes.



Annual progress reports which do not have a report number given are assigned an EXFOR report code A-, followed by the 3-digit institute code; when coded, the code is followed by the year for which the report is given.

Examples: A-ARK-84 or A-COL-1999

Dictionary 7. Conferences. Codes are up to 10 characters.

Conference codes are composed of the year of the conference given in the first 2 digits (up to 1999) or the first 4 digits (from the year 2000) of the code, followed by the place of the conference, which may have up to 6 characters.

Examples: 66PARIS
82ANTWER
2007NICE

Two conferences at the same place in the same year may be distinguished as shown in the following examples.

66ANL and 66ARGONNE
80BNL and 80BNL-2
69WIEN and 69VIENNA

Two expanded forms may be given: a short expansion, restricted in length to the explanation field of one record, which may be followed by a long expansion, starting on a new record and extending over more than one record. In Archive and DANIEL backup dictionaries, the short expansion is not enclosed in parentheses.

See also LEXFOR **Reference**.

Dictionary 16. Status codes.
The dictionary contains a subaccession number flag, as follows.

R - code must be followed by subaccession #
S - code may be followed by subaccession #

Dictionary 24. Data Headings. The data headings are used in the COMMON and DATA sections to define the contents of data fields. No expanded form of the codes is given.

Codes should be unique within Dictionary 24 and 25, *i.e.*, a data heading may not be identical to any data unit.

Many headings are identified by a family flag, which used for checking purposes and defines the category and the family (or independent variable type) within each category, according to the scheme in the following table.

Family	Flags	
	Variables	**Associated Quantities**[9]
Independent variables		
Incident energy	A	B
Resonance energy	C	D
Secondary energy[10]	E	F
Angle of outgoing particle	G	H
Product charge	I	
Product mass	J	
Number of particles	P	
Secondary linear momentum	L	
Linear momentum	M	R
Coefficient number	N	
Additional information[11]		
Sample thickness	K	
Flag	Z	
Sample temperature	8	9
Half life	6	7
Spin J	4	
Momentum *l*	2	
Parity	0	

An additional, more detailed classification scheme for headings is used in the Archive and DANIEL backup dictionaries; see Chapters 2 and 5.2 for details.

Dictionary 25. Data Units. The data units are entered in the COMMON and DATA section below the data heading to define the units for the contents of each field.

Codes are unique within Dictionary 24 and 25, *i.e.*, a data unit may not be identical to any data heading.

Each unit is assigned a dimension code, which provides a cross-link with Dictionary 24 and 236 (Quantity Dictionary), where the dimension code is also given (see page 10). This facilitates computerized crosschecks for consistency of quantities and units in a table.

Each unit is also assigned a conversion factor, which is given as a floating-point number and may be used for transforming units with the same dimension to standard units, for example:

[9] Associated quantities are those data heading keywords which contain the characters ERR or RSL
[10] Except LVL-INI and LVL-FIN.
[11] In certain cases, these may act as an independent variable with the exception of Flag.

energies	to electron-volts (eV);
angles	to degrees;
time	to seconds (s);
length	to meters (m);
cross sections	to barns (b).

In order to standardize the data unit codes, the following will be used:

PRT for outgoing particle, *i.e.*, for particle given in REACTION SF3 or SF7.

PRD for reaction product, *i.e.*, REACTION SF4.

INC for incident projectile, *i.e.*, REACTION SF2.

REAC for reaction, in general, REACTION SF2-SF3, with the exception that FIS will be used for fission.

PC for percent or per 100 particles.

Examples: PRD/FIS or PRT/REAC

Dictionary 33. Particles. All particles used in used in the BIB section are included in this dictionary, which contains a four-character "allowed use" flag as follows.

1st character	D – used in BIB keyword other than REACTION
2nd character	2 – used in REACTION SF2
3rd character	3 – used in REACTION SF3
4th character	7 – used in REACTION SF7

Dictionary 34. Modifiers (REACTION). An expanded form is only given for those general-quantity modifiers (at the beginning of the transmission dictionary) that may be included in the REACTION code, but are not included in the quantity codes given in Dictionary 36.

Dictionary 207. Books.

Book codes give a concise short title of the book, or the family name of the first author.

Examples:	ABAGJAN -	Group Constants for Nuclear Reactor Calculations, Abagjan, et al., 1964
	NEJTRONFIZ -	Neytronnaya Fizika, P.Krupchitskiy, 1961

Two expanded forms may be given: a short expansion, restricted in length to the explanation field of one record, which may be followed by a long expansion, starting on a new record and extending over more than one record. In Archive and DANIEL backup dictionaries, the short expansion is not enclosed in parentheses.

Dictionary 209. Chemical Compounds. The general compound code CMP can be combined with any element in the form (*Z*-*S*-CMP) without entry in this dictionary, which only lists special cases. The actual compound codes (*e.g.,* OXI for oxide) are restricted to three characters. The codes are sorted by atomic number of the principal element in the compound.

See also LEXFOR **Chemical Compounds**.

Dictionary 227. Nuclides and natural isotopic mixtures.

The **nuclide code** has the format *Z-S-A(-M)*

where: *Z* = the charge number, up to 3 digits, no leading zeros;
S = the element symbol; 1 or 2 characters;
A = the mass number; up to 3 digits, no leading zeros; a single zero denotes natural isotopic composition.

The code is right adjusted on Z, *i.e.*, the Z ends in the 3rd position, and continuing with no blanks in the code. All metastable states are labeled as –M.

The data associated with a nucleus are taken from the Nuclear Wallet Cards and the Audi-Wapstra Mass Tables. All nuclides given in the Nuclear Wallet Cards are included.

Dictionary 236. Quantities. The quantity code is composed of the codes for the REACTION subfields 5 to 8.
A short expanded form (not enclosed in parentheses) is given as a short definition of the quantity. A longer expansion (in parentheses) may follow on the comment lines.

Resonance parameters are flagged with a "." in column 52 (immediately preceding the short expansion).

All meaningful combinations of the codes that are in use are included in this dictionary, with the following two exceptions:

- These quantity codes do not include the **general-quantity modifiers** from Dictionary 34 (see remarks on this dictionary).

- The Particle Designator Field may contain a wildcard in place of an explicit code for the *particle considered*:

In order to keep the size of the dictionary to a minimum, specific particles are not always included in the particle designator field (REACTION SF7). Instead, this field may contain a code indicating that a particle designator (or designators) is legal for this quantity.

* All codes from Dictionary 33 with flag '7', and nuclides from Dictionary 227 except those with *use flag* 'Z' ;
*F Any fission fragment particle code is allowed, *i.e.*, FF, LF, HF.

If the particle designator is blank, only a blank field is allowed for that quantity[12].

If more than one particle designator must be given (*e.g.*, for correlations), the codes are given for each particle, separated by slashes.

Examples:
```
PAR,TTY,A
DA/CRL,P/D
,AKE,*F
,DA/DA,*/*
```

[12] This means that there must be a separate dictionary entry for the quantity with codes in SF7.

The *reaction type* code provides a cross-link to Dictionary 213 through which the necessary independent variables for each quantity (such as angles and secondary energies) are defined. This facilitates computerized checks of whether quantities and variables given in a table are consistent.
The *dimension* code provides a cross-link to Dictionary 25 (Data Units), where the dimension code is also given (see page 8). This facilitates computerized checks of whether quantities and units given in a table are consistent.

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Chapter 2

ARCHIVE DICTIONARIES

2.1 General Information and Format

The NRDC Dictionary Archive consists of a dictionary index file and a set of dictionary files, one for each dictionary, and contains all information necessary for the production of the DANIEL backup and the EXFOR transmission dictionaries.

The format and contents of the Archive Dictionary files are described in the following pages.

General Format

Dictionary Index (File name: `DICT_ARC.TOP`)

The dictionary index contains a list of all of the dictionary files stored, along with supplementary information.

The format of dictionary index line is:

Column(s)	1-3:	Dictionary number
	5-34:	Dictionary name
	36-37:	# of DANIEL keys
	39-78:	DANIEL record format

Dictionary Files (File names: `DICT_ARC_NEW.nnn`)

The dictionary files consist of two types of records: MASTER records and COMMENT records.

The general format of a MASTER record is:

Column(s)	1:	Alter flag
	2-4:	Status Code
	6-11:	Data of entry or last update
	13-42:	Key
	44-123:	Codes, expansions, *etc.* Format and contents are given under each dictionary.

The general format of a COMMENT record is (exceptions are noted under each dictionary):

Columns	1-33:	blank
	44-88:	comment

Alteration Flags

Dictionary updates are recorded on the Master Archive files by adding an alteration flag and the date of alteration. When a new transmission is run the flags are used to process the records for the output files, and are deleted from the Master Archive files.

The following flags are used to indicate an alteration to a dictionary record.

A The record has been added
D The record is marked for deletion
M A modification has been made to the Code-expansion field
S The status has been changed

Status Codes

A list of legal status codes (for all dictionaries) follows.

CIN	CINDA	used only by CINDA
EXT	extinct	no longer applies, but valid for older data sets
INT	internal	used only by DANIEL System
OBS	obsolete	not to be used on EXFOR exchange files
PRE	preliminary	do not need approval or are approved
PRO	proposed	are not yet approved
TRA	transmitted	sent to all centers on Dictionary transmission file

2.2 Contents of Dictionaries

The contents of the archive dictionaries are given in the following pages, along with the format of the MASTER records and any exceptions to the format of the COMMENT records.

For each MASTER record, the primary key is given first with the actual length of the key (however, all primary keys are stored as 20-character strings). Following the primary key, the secondary key, if it exists, and the contents of the dictionary line fields are given. The secondary key is also the first dictionary line field.

Dictionary 1: SYSTEM IDENTIFIERS
MASTER RECORD:
KEY: EXFOR CODE (A10)
field 1: INTERNAL NUMERICAL EQUIVALENT (I9)
field 2: EXPANSION (A55)

Dictionary 2: INFORMATION IDENTIFIERS
MASTER RECORD:
KEY: EXFOR CODE (A10)
field 1: EXPANSION (A25)
field 2: KEYWORD REQUIRED (A1)
R - required
B - one required
X - required when relevant
field 3: INTERNAL NUMERICAL EQUIVALENT (I2)
field 4: CODE REQUIRED OR OPTIONAL (A1)
R - required code
O - optional code
field 5: Dictionary no. for code (A3)

Dictionary 3: INSTITUTE CODES
MASTER RECORD:
KEY1: EXFOR CODE (A7)
KEY2: field 1: 3-character CINDA CODE (A3)
field 2: AREA, COUNTRY CODE (A4)
field 3: EXPANSION (A53)
field 4: COUNTRY, ORG. CODE FOR CINDA (A15)
COMMENTS:
Column 44: comment flag
= CINDA comment
Columns 45-88: comment

Dictionary 4: REFERENCE TYPE
MASTER RECORD:
KEY: EXFOR CODE (A1)
field 1: SHORT EXPANSION (A4)
field 2: POINTER TO RELATED DICTIONARY (A3)
field 3: LONG EXPANSION (A35)

Dictionary 5: JOURNAL CODES

MASTER RECORD

KEY1: EXFOR CODE (A6)

KEY2: field 1: CINDA CODE (A4)
field 2: AREA-COUNTRY CODE (A4)
field 3: ADDITIONAL AREA-COUNTRY OR ORGANIZATION CODE (A4)
1st character area code: 2nd country of origin
T: country of original publication
blank: organization code (1st code = *n*ZZZ)
field 4: SHORT EXPANSION (A20)
field 5: EXPANSION (A48)

COMMENTS:

Column 44: comment flag
+ addition to title
* full title
. translation of title
= CINDA comment

Columns 45-88: comment

Dictionary 6: REPORT CODES

MASTER RECORD:

KEY: EXFOR CODE (A11) (CINDA key is 8-character truncation of code)
field 1: INSTITUTE CODE (A7)
field 2: EXPANSION (A48)
field 3: CINDA FLAG (A1)
* Expansion not entered in CINDA book dictionary

COMMENTS:

Column 44: comment flag
= CINDA comment

Columns 45-88: comment

Note: This dictionary contains CINDA codes flagged with the status code CIN, which are not simply truncations of the 10-character EXFOR code.

Dictionary 7: CONFERENCE CODES

MASTER RECORD:

KEY: EXFOR CODE (A10) (CINDA key is 8-character truncation of code)
field 1: EXPANSION (A53)
field 2: AREA-COUNTRY CODE (A4)
field 3: 2ND AREA-COUNTRY OR ORGANIZATION CODE (A4)
1st character area code: 2nd country of origin
T: country of original publication
blank: organization code (1st code = *n*ZZZ)
field 4: CINDA SHORT CODE (A10)

COMMENTS:

Column 44: comment flag
(EXFOR long expansion
= CINDA comment

Columns 45-88: comment

Dictionary 8: ELEMENTS
MASTER RECORD:
KEY1: Z-NUMBER OF ELEMENT (I3)
KEY2: field 1: ELEMENT SYMBOL (A2)
field 2: ELEMENT NAME (A20)

Dictionary 10: STANDARD REACTIONS (CSISRS)
MASTER RECORD:
KEY: CSISRS CODE line format output (A2)
field 1: EXPANSION (A24)
field 2: INTERNAL NUMERICAL EQUIVALENT (A56)

Dictionary 11: FORBIDDEN REACTIONS (CINDA)
MASTER RECORD:
KEY: EXFOR CODE (A8)
field 1: EXFOR CODE (A50)

Dictionary 12: (Old) CINDA QUANTITIES
MASTER RECORD:
KEY: CINDA CODE (A3)
field 1: FISSION FLAG (A1)
field 2: INTERNAL NUMERICAL EQUIVALENT (I4)
field 3: CINDA SHORT EXPANSION (A14)
field 4: EXPANSION (A50)

[Dictionary 13: REACTION TYPE (for Dictionary 36)
(Superseded by Dictionary 213)
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: COMPUTATION FORMAT (A5)
field 2: ONLINE SYSTEM CODE (A4)
field 3: INDEPENDENT VARIABLE FAMILY CODE (I10)
field 4: EXPANSION (A65)]

Dictionary 14: REACTION DIMENSIONS (for Dictionary 36/236)
MASTER RECORD:
KEY: EXFOR CODE (A1)
field 1: EXPANSION (A55)

Dictionary 15: HISTORY CODES
MASTER RECORD:
KEY: EXFOR CODE (A1)
field 1: SHORT EXPANSION (A15)
field 2: LONG EXPANSION (A45)

Dictionary 16: STATUS CODES
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: INTERNAL NUMERICAL EQUIVALENT (I5)
field 2: EXPANSION (A55)
field 3: SUBACCESSION # FIELD FLAG (A1)

Dictionary 17: RELATED REFERENCE CODES
MASTER RECORD:
KEY: EXFOR CODE (A1)
field 1: EXPANSION (A53)

Dictionary 18: FACILITY
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)
field 2: SPECIAL USE CODE (A4)
NEUT, PHOT

Dictionary 19: INCIDENT SOURCE
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)
field 2: SPECIAL USE CODE (A4)
NEUT, PHOT
field 3: DELIMITER CODE (A1)

Dictionary 20: ADDITIONAL INFORMATION
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)

Dictionary 21: METHOD
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)
field 2: SPECIAL USE CODE (A4)
FY, NEUT

Dictionary 22: DETECTOR
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)
field 2: SPECIAL USE CODE (A3)
NEU, GAM

Dictionary 23: ANALYSIS
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)
field 2: SPECIAL USE CODE (A4)
RP

Dictionary 24: DATA HEADINGS

MASTER RECORD:

KEY: EXFOR CODE (A10)

field 1: DATA TYPE (2I1)

1st integer 0: flags, *etc.*

2nd integer 1: flag
2: decay flag
3: level flag
9: miscellaneous data

1: assumed values

2nd integer 1: monitor
5: assumed

2: data

2nd integer 1: data
2: ratio *(obsolete)*

3: resonance parameter

2nd integer 1: quantum number
2: energy

4: incident energy

2nd integer 1: energy
2: momentum
3: spectrum energy
4: spectrum temperature
5: wave-length

5: secondary energy

2nd integer 1: particle energy
2: level energy
3: excitation energy
4: Q value
5: energy degradation
6: energy gain
7: level number
8: linear momentum
9: polarity

6: angle

2nd integer 1: angle
2: cosine
7: q (momentum transfer)
8: wave number

7: number

2nd integer 5: coefficient number
8: kq

8: other variable

2nd integer 2: sample temperature
3: sample thickness
4: polarization
5: half-life
6: group number
7: decay constant

Dictionary 24: DATA HEADINGS (continued)

9: isotope/particle identification
2^{nd} integer 1: element
2: mass
3: isomer
4: monitor element
5: monitor mass
9: emitted nucleons

field 2: FAMILY CODE (A1)
field 3: PLOTTING FLAGS (I7)
col 1-3 - independent variable
col 4-6 - dependent variable
col 1 & 4: variable
1 - value
2 - minimum
3 - maximum
4 - approximate
[5 - one of multiple variables] – *no longer used*
9 - uncertainty or resolution
if col 1 = 1-5:
col 2: 1 - numerator
2 - denominator
if col 1 or 4 = 9:
col 2 & 5: +error; col 3 & 6: -error
1 - error
2 - resolution
3 - half resolution
4 - statistical error
5 - partial error
col 7 - reference frame flag
1 - c.m. system
field 4: UNIT CODE (A4)
field 5: SPECIAL USE FLAG (A1) (presently not used)
field 6: EXPANSION (A55)

Dictionary 25: DATA UNITS
MASTER RECORD:
KEY: EXFOR CODE (A10)
field 1: EXPANSION (A35)
field 2: FAMILY CODE (A4)
field 3: CONVERSION FACTOR (E11)
field 4: SORTING CODE (A3)

Dictionary 26: UNIT FAMILY CODES
MASTER RECORD
KEY: UNIT FAMILY CODE (A4)
field 1: DICTIONARY 24 USE (I2)
field 2: DICTIONARY 25 USE (I2)
field 3: DICTIONARY 36 USE (I2)
field 4: EXPLANATION (A50)

[Dictionary 27: NATURAL ISOTOPIC MIXTURES, NUCLIDES AND COMPOUNDS
(superseded by Dictionary 227)
MASTER RECORD:
KEY1: EXFOR CODE (A10)
KEY2: field 1: CINDA CODE (A5)
field 2: INTERNAL NUMERICAL EQUIVALENT (I6)
field 3: NUCLIDE USES (A13)
(See EXFOR Chapter 7 for field contents)
field 4: SPIN (E5)
field 5: for isotopes, ISOTOPIC ABUNDANCE (E11)
for natural element, ATOMIC WEIGHT (E11)
field 6: EXPANSION (A25)
filed 7: COMPOUND FLAG (A1) = '*'
COMMENT RECORD
Columns 44-45: OUTPUT DICTIONARY NUMBER FOR DANIEL (I2)
(blank after 1st MASTER Record).
Columns 46-98: COMMENT]

Dictionary 30: PROCESS CODES
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: INTERNAL NUMERICAL EQUIVALENT (I10)
field 2: EXPANSION (A55)

Dictionary 31: BRANCH CODES
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: INTERNAL NUMERICAL EQUIVALENT (I10)
field 2: EXPANSION (A55)

Dictionary 32: PARAMETER CODES
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: INTERNAL NUMERICAL EQUIVALENT (I10)
field 2: EXPANSION (A55)
field 3: SPECIAL USE CODE (A4)

Dictionary 33: PARTICLES
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: INTERNAL NUMERICAL EQUIV: Reaction SF2,3 (I6)
field 2: INTERNAL NUMERICAL EQUIV: Reaction SF7 (I5)
field 3: ALLOWED SUBFIELD FLAG (A4)
field 4: EXPANSION (A40)
COMMENT RECORD
Columns 44-45: OUTPUT DICTIONARY NUMBER FOR DANIEL (I2)
Columns 46-98: COMMENT

Dictionary 34: MODIFIERS
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: INTERNAL NUMERICAL EQUIVALENT (I10)
field 2: GENERAL QUANTITY MODIFIER FLAG (A5)
field 3: EXPANSION (A55)
COMMENT RECORD
Column 1: Flag
* replaces EXFOR expansion
Columns 45-99: Comment

Dictionary 35: DATA TYPE
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: INTERNAL NUMERICAL EQUIVALENT (I10)
field 2: EXPANSION (A40)

[Dictionary 36: QUANTITIES
(superseded by Dictionary 236)
MASTER RECORD:
KEY: EXFOR CODE (A30)
field 1: INTERNAL NUMERICAL EQUIV. Reaction SF5 (I6)
field 2: INTERNAL NUMERICAL EQUIV. Reaction SF6 (I6)
field 3: INTERNAL NUMERICAL EQUIV. Reaction SF7 (I6)
field 4: INTERNAL NUMERICAL EQUIV. Reaction SF8 (I6)
field 5: REACTION TYPE (A3)
field 6: REACTION DIMENSION (A1)
field 7: FAMILY CODE (A4)
field 8: EXPANSION (A48)
COMMENT RECORD
Columns 44-87: COMMENT]

Dictionary 37: RESULT
MASTER RECORD:
KEY: EXFOR CODE (A5)
field 1: EXPANSION (A53)

Dictionary 43: NLIB for Evaluated Libraries
MASTER RECORD:
KEY: NLIB NUMBER (A2)
field 1: LIBRARY NAME (A40)

Dictionary 44: Data Libraries
MASTER RECORD:
KEY: LIBRARY NAME (A20)
field 1: AREA-COUNTRY CODE (A4)
field 2: AREA-COUNTRY, ORGANIZATION CODE (A4)
1st character: area code; 2nd country of origin
blank; organization code (1st code = *n*ZZZ)
field 3: EXPANSION (A55)

Dictionary 45: New CINDA Quantities
MASTER RECORD:
KEY: NEW CINDA QUANTITY (A15)
field 1: WEB QUANTITY (A7)
field 2: EXPANSION (A53)

Dictionary 47: Old / New CINDA Quantities
MASTER RECORD:
KEY: OLD CINDA QUANTITY (A15)
field 1: REACTION (A10)
field 2: NEW CINDA QUANTITY (A4)

Dictionary 48: Alphabetic energy values for CINDA
MASTER RECORD:
KEY: ENERGY CODE (A15)
field 1: BOOK EXPANSION(A10)
field 2: DESCRIPTION (A44)

Dictionary 52: CINDA Reader Codes
MASTER RECORD:
KEY: READER CODE (A15)
field 1: CINDA READER(A60)
field 2: COUNTRY (A15)

Dictionary 113: Web Quantities
MASTER RECORD:
KEY: WEB QUANTITY (A15)
field 1: EXPANSION (A53)

Dictionary 124: DATA HEADINGS (for plotting, presently not used)
MASTER RECORD:
KEY: EXFOR CODE (A10)
field 1: DATA HEADING FOR PLOT (A50)

Dictionary 125: DATA UNITS (for plotting, presently not used)
MASTER RECORD:
KEY: EXFOR CODE (A10)
field 1: DATA UNIT FOR PLOT (A20)

Dictionary 136: QUANTITIES (for plotting, presently not used)
MASTER RECORD:
KEY: EXFOR CODE (A18)
field 1: QUANTITY FOR PLOT (A20)

Dictionary 144: Data Libraries for new CINDA
MASTER RECORD:
KEY: REF-TYPE, LIBRARY NAME (A20)
field 1: AREA-COUNTRY CODE (A4)
field 2: AREA-COUNTRY, ORGANIZATION CODE (A4)
1st character: area code; 2nd country of origin
blank; organization code (1st code = *n*ZZZ)
field 3: EXPANSION (A55)

Dictionary 207: BOOK CODES
MASTER RECORD:
KEY: EXFOR CODE (A10) (CINDA key is 8-character truncation of code)
field 1: EXPANSION (A53)
field 2: AREA-COUNTRY CODE (A4)
field 3: 2ND AREA-COUNTRY OR ORGANIZATION CODE (A4)
1st character area code: 2nd country of origin
T: country of original publication
blank: organization code (1st code = *n*ZZZ)
field 4: CINDA SHORT CODE (A10)

Dictionary 209: COMPOUNDS
MASTER RECORD:
KEY1: EXFOR CODE (A10)
KEY2: field 1: CINDA CODE (A5)
field 2: INTERNAL NUMERICAL EQUIVALENT (I6)
fields 3, 4, 5: not currently used
field 6: EXPANSION (A25)
COMMENT RECORD
Columns 44-35: OUTPUT DICTIONARY NUMBER FOR DANIEL (I2)
(blank after 1st MASTER Record).
Columns 46-98: COMMENT

Dictionary 213: REACTION TYPE WITH NEW CINDA QUANTITY
MASTER RECORD:
KEY: EXFOR CODE (A3)
field 1: NEW CINDA QUANTITY (A5)
field 2: WEB QUANTITY (A4)
field 3: SORTING FLAG (I2)
for TRANS dictionary 236
field 4: INDEPENDENT VARIABLE FAMILY CODE (I10)
1 – Resonance energy
3 – Secondary energy
4 – Angle
5 – Coefficient number
6 – Temperature
7 - Element, Mass
field 5: EXPANSION (A65)

Dictionary 227: NATURAL ISOTOPIC MIXTURES, AND NUCLIDES

KEY1: EXFOR CODE (A12)
KEY2: field 1: A-SYMBOL (A6)
field 2: INTERNAL NUMERICAL EQUIVALENT (I7)
field 3: USE FLAG (A1):
Z = not to be used in REACTION SF2,3,7, and in keywords DECAY-DATA, DECAY-MON, EN-SEC, HALF-LIFE, MOM-SEC, PART-DET, RAD-DET (where the appropriate particle codes are to be used)
field 4: SPIN/PARITY (A6)
field 5: HALF-LIFE FLAG (A1)
field 6: HALF-LIFE (E11)
field 7: HALF-LIFE UNITS (A3)
field 8: ISOTOPIC ABUNDANCE (E11)
field 9: ATOMIC WEIGHT (E12)
field 10: EXPLANATION (A21)

Dictionary 235: WORK TYPE
MASTER RECORD:
KEY: CINDA CODE (A1)
field 1: SHORT EXPANSION (A6)
field 2: LONG EXPANSION (A20)

Dictionary 236: QUANTITIES
MASTER RECORD:
KEY: EXFOR CODE (A30)
field 1: REACTION TYPE (A3)
field 2: REACTION DIMENSION (A1)
field 3: FAMILY CODE (A4)
field 4: Resonance flag (A1)
field 5: EXPANSION (A72)
COMMENT RECORD
Columns 44-87: COMMENT (LONG EXPANSION)

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Chapter 3

DANIEL BACKUP DICTIONARIES

The DANIEL Backup Dictionaries are a version of the dictionaries containing only the information needed for interfacing with computer programs, i.e. a subset of the information contained in the Archive dictionaries. They contain all codes and flags needed for computer programs, but no comments and free text explanations. They combine all dictionary information in one ASCII (text) file which can be used to generate (load) a dictionary database specific to a certain application (e.g. EXFOR check program) and/or a certain software platform.

The DANIEL Backup (File name: `DAN_BACK_NEW.9nnn` or `DAN_BACK_NEW.ALL`) consists of an index part (similar to the index file of the Archive dictionaries) and the actual dictionary records.

DICTIONARY INDEX Records:

Column	Format	Contents
1-3	I03	Dictionary number (blank signifies end of list)
5-34	A30	Dictionary name
36-37	I02	# of keys
39-82	A44	Dictionary field formats
84-87	I04	# of records in dictionary

DICTIONARY LINE Records:

Column	Format	Contents
1-3	I03	Dictionary number
5-7	A03	Status
9-14	I06	Date of entry or last update
16-45	A30	Dictionary key
47-126	A80	Dictionary fields

Status Codes

The status codes used are the same as in the Archive dictionaries, see Chapter 2.

Redefining the data base

Since the format of the records for each dictionary is contained in the dictionary index, fields may be re-defined, added, and/or eliminated without changing the programs. New dictionaries may be added and old ones eliminated by updating the index records.

Normally, a dictionary will be added through creating a new file for the Archive dictionaries. Then the archive index (DICT_ARC.TOP) must be updated accordingly, reflecting the contents of the new dictionary. Then an updated DANIEL Backup file can be generated by the appropriate software run at NDS (program MAKE_BACK).

Dictionary Contents

The contents of the DANIEL backup dictionaries are very similar to the Archive dictionaries, therefore below only the differences are mentioned:

- The DANIEL backup dictionaries do NOT include any of the COMMENT records of the Archive dictionaries

- Dictionary 1 (System Identifiers): Field 2 (Expansion) is NOT included
- Dictionary 25 (Data Units): Field 4 (Sorting code) is NOT included

See the description of the Archive dictionaries for the detailed contents.

Chapter 4

EXFOR TRANSMISSION DICTIONARIES

4.1 General Information and Format

The dictionary transmission files have much the same format as an EXFOR exchange file. Both the structure of the dictionary transmission files and the format of the individual dictionaries are described in this chapter. More detailed information for specific dictionaries of special interest is also included.

EXFOR Transmission Dictionaries (File name: TRANS.9nnn)

The first record on the dictionary transmission is a TRANS record; the last record is an ENDTRANS record (compare *EXFOR Exchange Formats Manual*, Chapter 2 on System Identifiers). The content of N1 and N2 is as follows.

- For the TRANS record, N1 and N2 are the same as for a regular EXFOR transmission file. "9" is used as the center identification character, although in column 67 the center identification "3" is used (as throughout the file).
- For the ENDTRANS record, N1 contains the number of dictionaries transmitted and N2 is blank.

Dictionary Format

The format of the transmitted dictionaries is generally similar to that of the BIB section in EXFOR entries.

Keyword or code: the keyword or code to be defined is given, left adjusted, in the first field, starting in column 1. The field is usually contained in columns 1-11, but may be longer for codes related to quantities. The keywords have a maximum length of 10 characters; some codes are restricted to a length of 3 or 5 characters (see Chapter 1, Table of Dictionaries).

Explanation: The explanation field usually starts in column 12 (in column 23, in the case of quantity codes) and usually (but with some exceptions) ends in column 66 of the first record.

Expanded forms are enclosed in parentheses; the opening parenthesis is given in the first column of the explanation field. The expanded form is normally restricted to the length of the explanation field of one record, but, for certain dictionaries (see pages 1.2–1.3), the expanded form may continue within the explanation field onto following records.

Free text may immediately follow the closing parenthesis of the expanded form or, if no expanded form is given, begin in the first column of the explanation field. It may continue within the explanation field, onto any number of records. The free text may include parentheses, but a left parenthesis that is part of the free text must not be entered in the first column of the explanation field (signaling the presence of an expanded form).

Record identification: The record identification (columns 67-79) of a dictionary record contains "30000" in columns 67-71, the dictionary identification number in columns 72-74 with leading zero(s), and the record sequence number with leading zeros in columns 75-79.

Flag: Column 80 is used

1. to flag certain validity conditions for the code given on the same record. These flags remain permanently attached to the respective codes or keywords. For an explanation of the **Obsolete flag** (O) and the **Extinct flag** (X) see Chapter 1.

2. as an indication that the record was altered since the last dictionary transmission (*i.e.*, added, deleted, corrected). See *EXFOR Exchange Formats Manual,* Chapter 8, for use of alteration flags.

The following two system-identifier records identify the beginning and the end of each dictionary (see *EXFOR Exchange Formats Manual,* Chapter 2, for record format).

1. **DICTION** is the **first record** of each dictionary.
   N1 - Dictionary identification number (see above).
   N2 - Date of last change (year, month, day - YYYYMMDD).
   Columns 34-66 describe the contents of the dictionary in free text.

   The record identification (columns 67-79) contains "30000" in columns 67-71, the dictionary number in columns 72-74, and the record sequence number "00001" in columns 75-79.

2. **ENDDICTION** is the **last record** of each dictionary.
   N1 - Number of records in the dictionary, excluding the DICTION and ENDDICTION records.
   N2 - Presently unused (may be blank or zero)

   The record identification is the same as in the DICTION record, except that the record sequence number is "99999".

The order of entries in each dictionary has been chosen for ease of use by compilers. It is the prerogative of each center to rearrange the dictionary for their own purposes if they wish, *e.g.*, for optimum computer use.

An example of a dictionary is shown below; columns 67-80 are omitted.

```
DICTION              5     200706 Journal Codes
AAA         (Astronomy and Astrophysics)                          2GER
AAB         (Anais da Academia Brasileira de Ciencias)            3BZL
AAF         (Annales Acad. Sci. Fennicae, Series A6: Physica)     2SF
AANL        (Atti Acad. Naz. Lincei,Rend.,Sci.Fis.,Mat.Nat.)      2ITY
            Atti della Academia Nazionale dei Lincei (Roma),
             Rendiconti, Classe di Scienze Fisiche, Mathematiche
             e Naturali
AAST        (Atti Acad. Sci. Torino, Cl.Sci.Fis.Mat.Nat.)         2ITY
            Atti della Academia della Scienze di Torino,
             Classe de Scienze Fisiche, Mathematiche e Naturali
ABS         (Memoires de l'Acad. Roy.Belg.,Cl.Sci.)               2BLG
AC          (Analytical Chemistry)                                1USA
ACA         (Analitica Chimica Acta)                              2NED
ACH         (Angewandte Chemie)                                   2GER
…….
ENDDICTION
```

4.2 Additional Information on Specific Dictionaries

Apart from the general differences explained in the Introduction, the contents of the EXFOR transmission dictionaries is similar to the Archive dictionaries; they contain the codes, code explanations, expanded forms and additional free text, but not all the flags included in the Archive and DANIEL backup dictionaries. This section deals only with additional information concerning such differences, e.g. with flags which are included but are in a different position on the dictionary record.

Dictionary 4. Type of reference. This dictionary is in the standard format except that columns 56-61 of the explanation field are reserved for the term "DICT *n*" pointing to the dictionary number *n* which contains the reference codes to be used with the given reference type. Columns 56-61 are blank when no dictionary applies.

Dictionary 5. Journals.
The area code and country code (country of publication) are in columns 63 to 66.

Dictionary 6. Reports.

The 7-character institute code (as in Dictionary 3) of the institute at which the report was issued is given in columns 60 to 66.
The dictionary is sorted on the institute code and, within the institute code, by report code. This sorting is different from the Archive and DANIEL backup dictionary which are sorted by report code.

Dictionary 7. Conferences.

The short expanded form is enclosed in parentheses (this is different from the Archive dictionary). The long expanded form is also given.

Dictionary 19. Incident Source.

This dictionary is in the standard format except that column 66 of the explanation field is reserved for a field delimiter which indicates that another code is expected following the given code, separated by the delimiter.

Dictionary 24. Data Headings.

The family flag is given in Column 66.

Dictionary 25. Data Units.

The format of the dictionary is as follows:

Column	1 - 10	code
	11	blank
	12 - 44	explanation of code (no expanded form given)
	45 - 48	dimension code
	49 - 55	blank
	56 - 66	conversion factor

Dictionary 207. Books.

The short expanded form is enclosed in parentheses (different from the Archive dictionary). The long expanded form is also given.

Dictionary 227. Nuclides and natural isotopic mixtures.

The code and fields 1 through 8 are as described in Chapter 2, Archive Dictionaries.
Field 9 (Atomic weight) is omitted.
Field 10 (Explanation) follows on the next line.

Dictionary 236. Quantities.

The format of this dictionary is as follows:

Columns	1 - 18	quantity code (or 1-44, see below)
	19 - 21	dimension code
	22	resonance parameter flag
	23 - 66	expanded form and free text.

1. Resonance parameters are flagged with a "**.**" in column 22.

2. The short expanded form is enclosed in parentheses (different from the Archive dictionary). The long expanded form is also given.

3. If the quantity code length is >18 characters, the code is continued on the same record and followed by blanks and "9" in column 66. The dimension code and the expansion follow on the next record in their assigned fields. Maximum code length = 44 characters.

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Chapter 5

RELATIONS BETWEEN QUANTITIES, HEADINGS AND UNITS

Embedded in the dictionaries is a variety of flags establishing connections and hierarchical relations between various dictionaries and the codes they contain, in particular quantities and the appropriate headings and units. These relations are essential for automatic checking of EXFOR input, conversion to computational formats and data processing, data plotting, comparison of experimental with evaluated data, etc. Furthermore, understanding of these relations is necessary for correct and consistent maintenance of the dictionary database, particularly when adding new codes.

These relations have mainly existed implicitly in the dictionary files, and were not conveniently summarized. This chapter attempts to give a concise summary of the most important of these relations; strictly speaking, it does not contain additional information, since – in principle – all of this chapter can be extracted from the dictionary files themselves and the descriptions of the previous chapters.

5.1 Hierarchy of Quantities

EXFOR quantity - Reaction Type - CINDA quantity - Web quantity

The EXFOR quantity dictionary (Dictionary 236) contains presently about 770 quantities. This is not only inconvenient but also confusing for many users, especially when retrieving data. Therefore, there have always been attempts to group these quantities into categories to make retrievals easier. At the same time, there were already more general “bulk” quantities; particularly, the quantities for the CINDA bibliography which has always been closely related to EXFOR; furthermore, for purposes of easy web retrievals, another quantity grouping system was developed. However, even though there were only around 45 CINDA quantities, the situation remained complicated because of the occurrence of numerous many-to-many relations (some of the 770 EXFOR quantities corresponded to more than one of the 45 CINDA quantities; and most CINDA quantities correspond to many EXFOR quantities). Within the EXFOR system, the “Reaction Type” flag constitutes another grouping of quantities reflecting not only the type of physical quantity but also serving as a link to the related independent variables (such as angles and secondary energies).

Since this large variety of quantity categories was found to exist, an attempt was made to streamline the situation when the “new CINDA” quantities were introduced; no many-to-many relations exist any more. A simple hierarchy of quantities has been established:

EXFOR quantity	**→ Reaction Type**	**→New CINDA quantity**	**→ Web quantity**
(~770)	(~117)	(~42)	(~25)
(Dict. 236)	(Dict. 213)	(Dict. 45)	(Dict. 113)

i.e., every EXFOR quantity belongs to only one Reaction Type; every Reaction Type belongs to only one CINDA quantity; and every CINDA quantity belongs to only one Web quantity.

This hierarchy makes the situation much easier to understand; also, software developers and/or users can decide on which level of detail they want to base their retrievals or retrieval software. At the same time, it requires additional care in the dictionary maintenance to keep the hierarchy with its structure intact; in particular when adding new EXFOR quantities, e.g. a new type of differential data, it has to be checked whether an existing Reaction Type can be used (which links to all necessary independent variables), or whether a new Reaction Type code is needed as well.

To make these hierarchies visible, two correspondence lists are given below:

- Correspondence Web quantity – CINDA quantities
- Correspondence CINDA quantity – Reaction Types

(To see the correspondence Reaction Type – EXFOR quantities, one could sort Dictionary 236 by Reaction Type. This is omitted here for space reasons.)

Correspondence Web Quantity - CINDA Quantities

Web Quantity (Dict.113)	**Corresponding CINDA quantities (Dict.45)**	**Expansion of Web quantity**
CS	TSL,CS,POT	Cross section data
CSP	CSN,CSP	Partial cross section data
CST	CST	Temperature-dependent cross section data
DA	DA,DAT,DAA,DT	Differential data with respect to angle
DAE	D3E,DAE,D3A,D4A	Differential data with respect to angle and energy
DAP	DAP	Partial differential data with respect to angle
DE	DE,DP	Differential data with respect to energy
DEP	DEP	Partial differential data with respect to energy
E	KE	Kinetic energies
FY	FY,CHG,FRS	Fission product yields
INT	INT	Cross section integral over incident energy
L	AMP	Scattering amplitudes
MFQ	NU,ALF,NUD,ETA,NUF	Miscellaneous fission quantities
MLT	MLT	Outgoing particle multiplicities
NQ	NQ	Nuclear quantities
POL	POD,POL	Polarization data
PY	PY	Product yields
RI	RI	Resonance integrals

RP	RP	Resonance parameters
RR	RR	Reaction rates
SP	SPC	Gamma spectra
SQ	KER,SIF	Special quantities
TT	TT	Thick target yields
TTD	TTD	Differential thick target yields
TTP	TTP	Partial thick target yields

Correspondence CINDA Quantity - Reaction Types

Status: August 2007

CINDA Quantity	Reaction Type	Reaction Type Expansion
ALF	ALR	Alpha at resonance
	ALF	Alpha (capture-to-fission cross section ratio)
AMP	L	Length or amplitude
	LP	Partial length or amplitude
CHG	ZP	Most probable charge
	ZPP	Most probable charge for given fragment energy
	ZPA	Most probable charge as a function of angle
CS	CS	Cross section
	CS4	Differential d/dAngle * 4pi
	CS+	Cross section (nonstandard)
CSP	CP4	Partial differential d/dAngle * 4pi
	CSP	Partial cross section
CST	CST	Temperature dependent cross section
D3A	D3A	Triple differential dAngle1/dAngle2/dE'
D3E	D3E	Triple differential dAngle/dE1'/dE2'
D4A	D4A	Quadruple diff. dAng1/dAng2/dE1'/dE2'
DA	FS2	Sine**2 coefficient
	DA	Differential d/dAngle
	FS	Sine coefficient
	FL	Legendre coefficient
	FC	Cosine coefficient
DAA	DAA	Double differential dAngle1/dAngle2
	D2P	Partial double differential dAngle1/dAngle2
DAE	DAE	Double differential dAngle/dE'
DAP	FCP	Partial cosine coefficient
	FLP	Partial Legendre coefficient
	DAP	Partial differential d/dAngle
	DPR	Partial angular distribution at resonance
DAT	FLT	Temperature-dependent Legendre coefficient
DE	DE	Differential d/dE'
	DE4	Differential d/dAngle/dE' * 4pi
DEP	DEP	Energy spectrum for specific group
DP	DPP	Diff.by lin.mom.of outg.part.,partl react.
	DP	Diff.by linear momentum of outg.part.
DT	DT	Diff.by 4-momentum transfer squared
ETA	ETR	Neutron yield (Eta) at resonance
	ETA	Neutron yield (Eta)
FRS	FAT	Fiss.fragm.ang.distr.,Temp.-dep.Leg. coeff.

CINDA Quantity	Reaction Type	Reaction Type Expansion
FY	FYE	Fission product yield, differental, d/dE
	FY	Fission product yield
	FYA	Fission product yield as fn. of angle
	APP	Most probable mass for given fragment energy
	FYS	Production cross section of fission products
	FYZ	Fission mass yield
	APR	Most probable mass at resonance
	AP	Most probable mass
	FYP	Fiss.prod.yield as fn.of sec.part.energy
	APA	Most probable mass as a fn. of angle
INT	IP4	Cs integral over inc.en.,d/dA*4pi,for E'or lvl
	IAP	Cs integral over inc.en for partl.angle
	IT4	Cs integral over inc.en., d/dAngle * 4pi
	INT	Cross section integral over incident energy
	IDA	Cross section integral over inc.en., d/dAngle
	IDE	Cs integral over inc.en., d/dE'
	ITR	Cs integral over inc.en.,at resonance
	INP	Cs integral over inc.en.for given E' or level
KE	EDA	Kinetic energy, differential, d/dAngle
	RPE	Resonance kinetic energy
	E	Kinetic energy
	EA	Kinetic energy as a fn. of angle
	EP	Kinetic energy for specific groups
KER	KER	Kerma factor
MLT	MLT	Multiplicity
	MTE	Multiplicity, partial or d/dE
	PZ	Partial multiplicity
	YAE	Double-diff. mutiplicity for thick target
	PZR	Partial multiplicity at resonance
	MTA	Multiplicity d/dA
	MTR	Multiplicity at resonance
NQ	NQ	Nuclear quantity
NU	NUR	Neutron yield at resonance
	NU	Neutron yield (nu-bar)
	NUP	Probability for emission of N neutrons
NUD	PN	Delayed neutron emission probability
	NUD	Delayed neutron yield (nu-bar delayed)
	GZ	Yield of half-life group
NUF	NUF	Neutron yield for fiss.fragments
	NUE	Neutron yield dep.on sec.particle energy
POD	PTD	Differential polarization, d/dAngle, tensor
	PTP	Partial diff.polarization, d/dAngle, tensor
	POD	Differential polarization, d/dAngle
	PDE	Differential polarization, d/dAngle/dE'
	PPD	Partial differential polarization, d/dAngle
	P4A	Anal.power dA1/dA2/dE1/dE2 for 2 particles
	PDT	Differential polarization, d/d(-t)
	P3A	Analyzing power dA1/dA2/dE1 for 2 particles
POL	PPO	Partial polarization
	PO	Polarization
	PPF	Partial polarization fitting coefficient
	POF	Polarization fitting coefficient
POT	POT	Potential scattering cross section
PY	PY+	Product yield(other than fission, nonstandard)
	PYA	Product yield d/dAngle
	PY	Product yield (other than fission)
	PY2	Double-diff. Product yield d/dAngle/dEnergy
	PYP	Partial product yield

CINDA Quantity	Reaction Type	Reaction Type Expansion
	PYQ	Partial product yield d/dAngle
RI	RIL	Resonance integral over limited energy range
	RI	Resonance integral
RP	RE	Resonance energy
	RPP	Partial resonance parameter
	RP	Resonance parameter
RR	RR	Reaction rate
	RRP	Partial reaction rate
SIF	SIF	Self-indication function
SPC	SPR	Spectrum at resonance
	SP	Secondary energy spectrum
	SPA	Secondary energy spectrum as a funct.of angle
	SPP	Partial sec. energy spectrum (for given level)
TSL	TSL	Thermal-neutron scattering cross section
TT	TT+	Thick target yield (nonstandard)
	TT	Thick target yield
TTD	TDP	Partial diff. thick target yield, d/dAngle
	TDA	Differential thick target yield, d/dAngle
	TD2	Differential thick target yield, d/dAngle/dE'
	TDE	Differential thick target yield, d/dE'
TTP	TTP	Partial thick target yield

5.2 Dictionary 24 classes

As mentioned in Chapter 1, the data headings collected in Dictionary 24 are categorized in two ways: the Family Flags as described in Chapter 1, and two numerical “Data type” flags as described in Chapter 2. (The EXFOR Transmission dictionaries contain only the family flags.) The following table combines the Data type flags with the headings for which they are used, and with the Family flags. It should also be noted that the Archive and DANIEL backup dictionary 24 contain additional flags (“plotting flags”) which are not included in the table below; see Chapter 2 for more details.

Dictionary 24 Classes (Status August 2007)

D.type 1	D.type 1+2	Explanation	Headings	Fam. (val/err.)
0 Flags	01	Flag	FLAG	Z
	02	Decay flag	DECAY-FLAG	Blank
	03	Level flag	LVL-FLAG	Blank
	09	Misc. data	MISC*, LVL*	Blank
1 Assum.	1 blank	Normalization points	*-NRM	Blank
	11	Monitor	MONIT*	Blank
	15	Assumed	ASSUM*	Blank

D.type 1	D.type 1+2	Explanation	Headings	Fam. (val/err.)
2 Data	21	Data	DATA*, ERR*	* / blank
	22	Ratio	RATIO* (obsol.)	* / blank
3 ResPar	31	Quantum no.	STAT-W G, SPIN J, MOMENTUM L, PARITY	4,4, 2, 0
	32	Energy	EN-RES*, MU-ADLER	C / D
4 Inc.En.	41	Energy	EN* except 43	A / B
	42	Momentum	MOM*	M / R
	43	Spectrum energy	EN-MEAN*, EN-DUM*	A / B
	44	Spectrum temperature	KT*	A / B
	45	Wave-length	WVE-LN	A
5 Sec.En.	51	Particle energy	E, E1,…,S-MEAN,E-TR, E-RL	E / F
	52	Level energy	E-LVL*	E / F
	53	Excitation energy	E-EXC*	E / F
	54	Q value	Q-VAL*	E / F
	55	Energy degradation	E-DGD*	E / F
	56	Energy gain	E-GAIN*	E / F
	57	Level number	LVL-NUM*, IAS-NUMB	E
	58	Linear momentum	MOM-SEC*, M1-SEC-MAX etc.	L
	59	Polarity	POLAR*	E
6 Angle	61	Angle	ANG*	G / H
	62	Cosine	COS*	G / H
	67	Q (momentum transfer)	MOM-TR, q	G / H
	68	Wave number	WVE-NM	G
7 Number	75	Coefficient number	NUMBER, NUMBER-CM	N
	78	Kq	KQ	N
8 Other	82	Sample temperature	TEMP	8 / 9
	83	Sample thickness	THICKNESS	K
	84	polarization	POL-BM, POL-TR	blank
	85	Half-life	HL*	6 / 7
	86	Group number	GRP-NUM	N
	87	Decay constant	DCNST	N

D.type 1	D.type 1+2	Explanation	Headings	Fam. (val/err.)
9 Isot.id.	91	Element	ELEMENT, ELEM1, etc.	I
	92	Mass	MASS, MASS-RATIO, etc.	J
	93	Isomer	ISOMER*	J
	94	Monitor element	ELEM-NRM	blank
	95	Monitor mass	MASS-NRM	blank
	(98	Effective mass squared	EMS* *(obsolete)*	S)
	99	Emitted nucleons	PART-OUT	P

5.3 Dictionary and Checking Logic around Quantities, Headings and Units

When updating the relevant dictionaries, or when compilers propose new codes for quantities, headings or units, it is useful to visualize the relations between the relevant dictionaries and those fields which occur in more than one of them. These relations are shown on the figure below.

Dictionary and Checking Logic around Quantities, Headings and Units