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User's Manual for The List of Parts

REFERENCE

MASTER

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USER'S MANUAL
FOR
THE LIST OF PARTS

REFERENCE

Prepared by:

C. W. Laub

B. C. Wells

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Approved by:

J. A. Burgess
Manager
Reactor Engineering Administration

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Introduction	1-1
2	List of Parts	2-1
3	Work Copy	3-1
4	Maintenance of LOP	4-1
5	Input Technique	5-1
6	Preparation of New LOP	6-1
7	Component Test LOP	7-1

Appendix

A.	Computer Program Listing
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LIST OF ILLUSTRATIONS

<u>Figure No.</u>	<u>Title</u>
2-1	Assembly Drawing and List of Parts Structure
2-2	Sample List of Parts Format
3-1	Sample Work Copy Format
3-2	Sample Quantity Calculation
4-1	Sample Input Form
4-2	Typical ECO Input
5-1	Part Number Format
7-1	Sample Component Test LOP Format
7-2	Sample Component Test Work Copy Format

LIST OF ABBREVIATIONS

AR	As required
Assy	Assembly
ECO	Engineering Change Order
EML	Engineering Mechanics Laboratory
LOP	List of Parts
LSP	List of Special Parts
NHA	Next higher assembly
Qty	Quantity
TFL	Thermo Flow Laboratory
SOQ	Supplemental ordering quantity

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1. INTRODUCTION

Early in the development of the NERVA reactors, the need for a flexible parts control system was recognized. Since there are several hundred parts in a reactor, any of which are subject to one or more revisions, it is imperative that a record of the revision released for a given reactor be readily available. For such a system to be effective, it must be:

Accurate	- Since other groups will be working to the output.
Easy to understand	- It will be used by many people of varying skill and training.
Easy to update and issue	- Because many changes will be processed during a development program.
Timely	- Because of the risk and expense associated with working to outdated information.

WANL developed a computerized parts list system which could meet these requirements. This report describes the system and provides insight into its operation.

The purpose of this report is twofold: (1) to provide general information for users of the List of Parts (LOP) output and (2) to provide detailed instructions for the preparation and maintenance of a LOP. Sections 2 and 3 describe the LOP system, and sections 4 - 7 provide detailed instructions for preparation and maintenance.

This manual describes the LOP and relates it to the engineering release system. The LOP system consists of two major printouts: (1) The List of Parts and (2) the Work Copy. The List of Parts is arranged in an indented format and is used for part number control. Since it shows all detail parts in their proper relationship to subassembly and assembly drawings, it is frequently referred to as the "Christmas Tree".

On the other hand, the Work Copy is a listing of part number information arranged in part number sequence. The computer program tabulates every entry for each part number and calculates the total quantity requirements. Since each entry for a given part shows where the part is used (in its next higher assembly), the Work Copy also serves as an index for locating all of the assemblies that use a particular part number.

There are two keystones in the List of Parts system: the assembly drawings and the Engineering Change Order system. The List of Parts is tailored directly after the bills of material information from all assembly drawings, but it provides the added advantage of electronic data processing capabilities (numerical sorting, alphabetical sorting, total quantity calculations, etc.). Although the Lists of Parts are normally constructed before the assembly drawings are available, the assembly drawings are later used to check the List of Parts information.

The Engineering Change Order (ECO) system is the communications media for the LOP. It is used to release or revise information contained in the Lists of Parts. All information must be authorized by an approved ECO before the information can appear in a List of Parts. This is a cardinal rule which must not be violated if the List of Parts is to be a meaningful document. Details of the ECO procedure can be found in the WANL Divisional Procedures Manual and in the report, WANL-TMI-1823.

2. LIST OF PARTS

2.1 CONSTRUCTION

The List of Parts provides part-number control for all reactor parts by listing all items appearing in the bills of material of the various assembly drawings.

Figure 2-1A shows the assemblies for a typical reactor. They are arranged in the order in which the parts are assembled, reading from the bottom to the top of the chart. Note that the core assembly and reflector are assembled in parallel to build a reactor assembly. The shield is assembled to the reactor before it is placed in the pressure vessel. And, finally, the reactor-vessel assembly (shown as R/V) represents the completed product.

The List of Parts is designed to parallel the assembly drawing structure as shown in Figure 2-1B. A family tree of LOP's contains all of the items needed to build the reactor, plus certain special items needed for supporting activities. (component test hardware, specification information and substitution hardware) For identification purposes, each of the assemblies are assigned a code, shown by the numbers in parenthesis in the illustration. This is described further in Section 3.

FIGURE 2-1A
TYPICAL ASSEMBLY DRAWING
STRUCTURE

FIGURE 2-1B
TYPICAL LIST OF PARTS
STRUCTURE

2.2 FORMAT

The LOP is printed in seven columns as shown in Figure 2-2. The Part Descriptions are indented to indicate that these items are required to build an assembly, thus forming the outline of a Christmas Tree from which the LOP derives its nickname.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
SEQUENCE NUMBER	LEVEL	PART DESCRIPTION	PART NUMBER	NEXT HIGHER QUANTITY	ASSEMBLY PART NUMBER	RELEASE NUMBER
20	A	REFLECTOR ASSEMBLY(HOLD)	938J215G01M	1		14,699
30	B	DRUM ASSY, CONTROL	909E236G01-	11	938J215G01M	13,131
40	C	DRUM, CONTROL DRUM ASSY.	938J196G01B	1	909E236G01-	14,466
50	D	HOUSING	978D319M01A	1	938J196G01B	12,479
60	D	CYLINDER	938J195M01A	1	938J196G01B	13,102
70	E	CYLINDER, RAW MAT'L	978D350M02-	1	938J195M01A	11,898
80	C	SHAFT, D.E. (MOIC/D ACC)	937J394M01E	1	938J196G01B	14,240
90	D	SHAFT, NOZZLE END BEARING	909E240M01B	1	938J196G01B	13,166
100	D	SPRING	979D589M01-	1	938J196G01B	13,009
110	D	PIN(MO1-ACC)	964B177M01A	6	938J196G01B	13,281
120	D	CONTROL PLATE ASSY.	977D791G01B	3	938J196G01B	12,479
130	E	PLATE (HOLD ACC)	909E267M01E	1	977D791G01B	13,391
150	E	RIVET (MO1B ACC)	945C507M01C	59	977D791G01B	12,606
160	E	COLLAR MO1B ACC	963B090M01C	59	977D791G01B	12,606
170	C	BOLT	946C319M01-	4	938J196G01B	12,479
175	C	CEMENT (AR)	M53314JC	-0	938J196G01B	13,131
180	D	LOCKING DEVICE, BOLT(MO1C ACC)	944C461M01E	4	938J196G01B	12,674
190	D	PIN	946C627M01A	42	938J196G01B	13,131
195	D	FILLER MATERIAL (AR)	938J196 IT14	-0	938J196G01B	14,466

Figure 2-2 Sample List of Parts Format

2.2.1 Sequence Number

The Sequence Number (column 1) is a number assigned to place the item in its proper position in the LOP. The numbers are assigned by the LOP Technician when he prepares the input based on the available design information.

2.2.2 Level

The Level code letter (column 2) is used to establish the relationship between individual components and assemblies. Level code A is the highest level that can be assigned to any item in a List of Parts, and Level G is the lowest level that can be assigned. The computer program automatically indents the Part Description two spaces for each Level code from B thru G.

Example: At Sequence No. 20, the Reflector Assembly is a Level A.

Figure 2-2 illustrates how the components in the Reflector Assembly are arranged with level codes. The Collar, Rivet, and Plate (sequence numbers 160, 150, and 130) are marked Level E. These parts form the Control Plate

Assembly (sequence number 120) which is a Level D. Control Plate Assemblies plus the Level D items (sequence numbers 110, 100, 90, 80, 60, and 50) form the Drum, Control Drum Assembly (sequence number 40). Note that sequence number 40 is a Level C item.

The Control Drum Assembly (sequence number 30) is a Level B item comprised of all of the Level C items listed.

Several drum assemblies are required for a Reflector Assembly which is a Level A.

2.2.3 Part Description

The Part Description (column 3) is the name of the component of assembly. In most instances, it is derived from the drawing title block or bill of material; however, general descriptions are acceptable.

Example: sequence number 175, Cement
sequence number 332, Lubricant

2.2.4 Part Number

The Part Number (column 4) is the identification number of the component or assembly. It may consist of:

- 1) The drawing number plus an item number (H01) or group number (G01) followed by the part revision letter (H01E) or (G01B). (See WANL Divisional Procedure 300 for additional details on the WANL part numbering system.)

Example: Housing 978D315H01A

- 2) Standard parts manufactured to acceptable specifications.

Example: Washer MS157950818

- 3) Materials manufactured to acceptable specifications.

Example: Lubricant PDS 30164-1

2.2.5 NHA Quantity

The NHA Quantity (column 5) given is the amount required to make one of the next higher assemblies.

Example: 59 collars (Sequence No. 160) are required for each

control plate assembly (Sequence No. 120).

2.2.6 NHA Part Number

The NHA Part Number (column 6) identifies which assembly uses the components specified in columns 3 and 4. The computer program determines the NHA Part Number automatically from the Sequence Number/Level Code relationship and prints it in the output.

Example: At Sequence No. 70, the NHA Part Number for the Cylinder, Raw Material is 938J195H01A, which is the part number for the Cylinder (Sequence No. 60).

2.2.7 Release Number

The Release Number (column 7) is the number of the last approved ECO releasing or revising the part.

Example: ECO 13009 revised the Spring (Sequence No. 100)

2.3 LIST OF SPECIAL PARTS

Frequently, it is necessary to order alternate, or backup, designs for some reactor components. These parts are ordered in addition to the normal (prime design) reactor hardware, but the backup parts (also referred to as prime alternate parts) are tabulated in the List of Special Parts (LSP).

The LSP follows the same format as the Reactor LOP. Parts are usually grouped by major assembly, such as, Core, Reflector, Shield, etc., for ease of locating them. The major assemblies are listed as Level Code A and are spelled out in the Part Description column. The backup parts are also listed as Level Code A and the total quantity required is shown in the NHA Quantity column.

3. WORK COPY

3.1 CONSTRUCTION

The Work Copy repeats the information from the LOP and rearranges it in part-number sequence to provide a check list against part number and quantity released for a reactor. This list is useful to other departments since it provides a summary for each part released for the reactor.

3.2 FORMAT

The Work Copy is printed in ten columns as shown in Figure 3-1. The ten columns include the same seven used in the List of Parts plus three additional columns: Reactor Code, Assembly Code, and Group Quantity.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
REACTR CODE	ASSY CODE	SEQ NUM	LEVEL	PART DESCRIPTION	PART NUMBER	NMA QTY	RELEASE NUMBER	GROUP QUANTITY	NMA PART NUMBER
6	3	160	E	COLLAR HO18 ACC	9638090H01C	59	12,606	1947	9770791G01B
6	3	1630	E	COLLAR HO18 ACC	9638090H01C	59	12,606	177	9770791G01B
REFLECTOR ASSEMBLY			TOTAL ENTRIES = 2 FOR PART NUMBER 9638090H01C			TOTAL REQUIRED = 2124			
TOTALS FOR NRX-A6			TOTAL ENTRIES = 2 FOR PART NUMBER 9638090H01C			TOTAL REQUIRED = 2124			

Figure 3-1 Sample Work Copy Format

3.2.1 Reactor Code

The Reactor Code (column 1) identifies the reactor by number. This number is part of the data address for the computer tape.

Example: Reactor code 6 for NRX-A6.

3.2.2 Assembly Code

The Assembly Code (column 2) identifies the assembly for which the part is released. In Figure 2-1B the Reflector Assembly is assigned assembly code 3. The Work Copy will show Assembly Code 3 for all parts required for the Reflector Assembly. The Assembly Code is also used as part of the data address on the tape.

3.2.3 Group Quantity

The group quantity (column 9) lists the total quantity of each part released for a code Level Assembly. Figure 3-2 shows the sequence of calculations made by the computer to determine a total quantity of 2124 collars required for the Reflector Assembly.

In this example, the computer starts with Level E and performs one calculation for each code level through Level Code A. Since there are two places in the LOP where the collar 963B090H01 appears, the computer will perform this operation twice to arrive at totals of 1947 collars and 177 collars. These totals are then summed to show a grand total of 2124 collars required for a Reflector Assembly.

<u>Level</u>	<u>Part Description</u>	<u>Part Number</u>	<u>NHA Qty</u>
A	Reflector Assembly	938J215G01M	1
B ₁	Drum Assembly	909E236G01-	11
C ₁	Drum, Control	938J196G01B	1
D ₁	Plate Assembly	977D791G01B	3
E ₁	Collar	963B090H01C	59
B ₂	Drum Assembly	909E236G02-	1
C ₂	Drum, Control	938J196G02B	1
D ₂	Plate Assembly	977D791G01B	3
E ₂	Collar	963B090H01C	59

The computer calculates the total quantity of collars as follows:

$$\begin{aligned}
 \text{Grand Total} &= (E_1 \times D_1 \times C_1 \times B_1 \times A) + \\
 \text{Collars} & (E_2 \times D_2 \times C_2 \times B_2 \times A) \\
 &= (59 \times 3 \times 1 \times 11 \times 1) + \\
 & (59 \times 3 \times 1 \times 1 \times 1) \\
 &= 1947 + 177 \\
 \text{Grand Total} &= 2124 \text{ (in a Reflector Assembly)} \\
 \text{Collars} &
 \end{aligned}$$

Figure 3-2 Sample Quantity Calculation

4. MAINTENANCE OF LIST OF PARTS

4.1 BASIC RULES

The rules that must always be obeyed in any change in the List of Parts are as follows:

- 1) All ordering information (part number and quantity) must be authorized by an approved ECO.
- 2) No entry contained in the List of Parts concerning ordering information shall be in conflict with an approved ECO.
- 3) Only approved ECO's can be used for LOP input.

4.2 GENERAL

The maintenance of a List of Parts is controlled by the Engineering Assistant assigned to that particular reactor. This person has the complete responsibility for preparation and maintenance of the List of Parts to which he is assigned. These include the following:

- 1) Collection of input.
- 2) Decision to publish a new issue.
- 3) Preparation of record log.
- 4) Preparation of input.
- 5) Checking of input.
- 6) Transmittal to computer.
- 7) Checking of output.
- 8) Local distribution.

4.3 COLLECTION OF ECO's

A file of current ECO's will be maintained for each reactor List of Parts. A status index should be kept in the front of the file showing what stage the ECO is in, i.e., rough draft, review, approved or incorporated in the computer input. The file can be easily maintained by removing the existing copy when a

later one is received. The purpose of collecting copies of the intermediate stages of the ECO is to evaluate the scope and work load of the LOP input.

4.4 DECISION TO ISSUE

There is no exact rule regarding how often input should be prepared, but normally when fifteen to twenty approved ECO's are accumulated, a new LOP should be issued. This figure reflects a level of design activity and will usually provide sufficient input to issue the LOP either once or twice a month. From past experience, this basis provides a new LOP before the last issue becomes too out-dated to work with.

4.5 PREPARATION OF RECORD LOG

Upon deciding to prepare a new issue, all of the approved ECO's should be removed from the file and recorded in the Record Log book. This log book provides a permanent document showing which ECO's were included in a particular issue and when the issue was released. The revision letters of the various assembly LOP's and any pertinent remarks regarding problems or inconsistencies should also be recorded in the log book. The completed log is valuable as historical data when budgeting and scheduling future LOP's.

Also, a copy of the same information should be given to the Engineering Assistant in Material Control so he may update his records.

4.6 INPUT PREPARATION

It is the task of the Engineering Assistant to present the new information (input) as taken from the LOP section of the approved ECO and present it in such a manner so that keypunched computer cards may be prepared. The following describes the information needed for an LOP input:

4.6.1 Address

Since all data is stored on magnetic tape or disc file in a specific location, information can only be reached by calling for the address of that specific location. The address consists of the following:

- a) reactor code
- b) assembly code
- c) sequence number

4.6.2 Ordering Information

The basic principle is to specify the address and then provide the ordering information desired for that address. This information is as follows:

- a) level code
- b) part description
- c) part number
- d) quantity
- e) ECO number

4.6.3 Operation Code

The Operation Code tells the computer what is done with the ordering information at the address specified. There are only three operations used -- Add, Delete and Change.

- a) An Add card will add to the tape the specific address called for and the ordering information provided. An Add card cannot be used when that specific address already exists. The Operation Code for an Add is 1.
- b) A Delete card will remove from the tape the specific address called for and the existing ordering information. In designating a Delete, only the address and Operation Code need be specified. The Operation Code for a Delete is 0.
- c) A Change card is used when it is desired to change the existing ordering information at a specific address. A Change is prepared by finding the particular entries to be changed in the Work Copy and marking up those entries with the new information. The Operation Code for a Change is 2 and is automatically supplied by the keypunch operator. A Change card cannot be used under the following conditions:
 - 1) Change an existing address to a new address.
 - 2) When there is an Add or Delete card at the same address.

4.6.4 Input Form

The problem of the actual input writing is solved by using two forms. The choice of the form is dependent upon the operation being performed. For a Change, a marked-up Work Copy is used since this avoids the duplication of rewriting existing information. The keypunch operator can punch the new information along with the existing without any intermediate step. However, in marking up the Work Copy, the Engineering Assistant must pay special attention to clarity since there are no columns available to avoid confusion. If the operation is either an Add or Delete, then the standard input form must be used. In rare cases where there is possibility of confusion and error by making a change on the Work Copy, this form should also be used. Figure 4-1 shows a sample of the standard LOP input form. The form is preprinted with classified security markings to avoid individual classification each time input is written. A complete description of the form follows:

Column 1	--	Reactor Code -- single digit from 0 thru 9.
Column 2	--	Assembly Code -- a single digit from 0 thru 9.
Columns 3-7	--	Sequence Number -- Accepts only numbers and must be written as follows: Column 7 - units Column 6 - tens Column 5 - hundreds Column 4 - thousands Column 3 - tens of thousands
Column 8	--	Level Code -- letters A thru G
Columns 9-38	--	Part Description -- Accepts any combination of alphanumeric data.
Columns 39-50	--	Part Number -- Accepts any combination of alphanumeric data.

Columns 51-55	--	Quantity -- Accepts only numbers and must be written as follows:
Column 55	-	units
Column 54	-	tens
Column 53	-	hundreds
Column 52	-	thousands
Column 51	-	tens of thousands
Columns 56-61	--	ECO -- Accepts any combination of alphanumeric data.
Columns 62-79	--	Not used.
Column 80	--	Operation Code -- a single digit from 0 to 2.

4.6.5 Sample Input

We will now take a sample ECO and prepare the input. Figure 4-2 shows a sample ECO that is simple in nature but entails the manipulation of the three basic operations. The number at the top (937J703G01) represents the Reactor Assembly LOP for the NRX-A6. The four underlined headings mean the following:

1) Component	--	Same as Part Description.
2) Was	--	Shows what the existing Part Number is.
3) Now	--	Shows what the new Part Number should be.
4) Quantity	--	Tells how many of that Part Number are required.

The first step is to resolve the three lines of information underneath the heading into the three basic operations. (In order to do this, read again the section on Operation Code.) Referring back to Figure 4-2 the line (1) will be a Change since only the revision letter of the Part Number is changed. Line (2) is an Add, and line (3) is a Delete.

The written input for these three lines from Figure 4-2 would be thus:

- line (1) - Since this line is a Change, it has been done simply by locating 978D875H01K in the Work Copy, drawing a line through revision letter K and the old ECO number, and writing in revision letter L and ECO Number 16147 beside them.

- line (2) - Since this line was an Add, the address and the level code had to be supplied. The reactor and assembly codes were known, since they were pre-established when the LOP was initiated. The level code was determined to be a B since the part was going directly into the Reactor Assembly and not into a subassembly first. Since the Reactor Assembly is an A, then this part must be a B. The sequence number was arbitrarily selected as long as it met the conditions of the level code.

- line (3) - Since this line was a Delete, all that had to be done is specify the address and Operation Code. The address was determined by locating 947C544H02C in the Work Copy and copying the information onto the input sheet.

Although this ECO is a simple one, the same methods apply no matter how complex the ECO may be. Some "tricks of the trade" items will be discussed in Section 5. (Input Techniques).

4.7 CHECKING OF INPUT

After completing the initial writing of the input, a check should be made of all entries with particular attention to the following areas:

- 1) Agreement with the Basic Rules. Only approved ECO's were used.

4. SECURITY CLASSIFICATION

ECO WORKSHEET (Continuation)

937J703G01

SHEET 2 OF 2

1. ECO NO.

16,147

2. DESCRIPTION (PARTS LIST NOS., PART NOS. WAS/NOW)

	<u>Component</u>	<u>Was</u>	<u>Now</u>	<u>Qty</u>
(1)	Bolt, Tie	978D875 H01K	978D875H01L	
(2)	Clamp, Tie Bolt	---Add---	947C643H02-	2
(3)	Locking Device	947C544H02C	---Delete---	

3. DISPOSITION/ORDERING SERVICES REMARKS (CONT'D)

4. SECURITY CLASSIFICATION

- 2) Agreement with the ECO. The input does what the ECO said to do.
- 3) Missing Information. All the entries have been properly filled without omitting sequence numbers, level codes, etc.
- 4) Inconsistent Information in Multiple Entries. In many cases, there will be more than one ECO against a particular part. In working with multiple entries, it must be watched that the input does not try to Change a part which is being Added or Deleted. The input should reflect the net result of all the ECO's.
- 5) Double Sequence Numbers. A part that is being Added is not given the same sequence number as one that is already being used.
- 6) Clarity of Writing. All the entries are legible.

The above topics will be discussed in further detail in Section 5, "Input Technique".

4.8 TRANSMITTAL TO COMPUTER

The input should be sent as a complete package to the Computer Department. The following items should be written on a separate sheet and included.

- 1) The total number of input sheets.
- 2) The new revision letters of the various Assembly LOP's. (next consecutive letter but do not use I, Ø, Q, and X)
- 3) Any special instructions or explanations.
- 4) The particular list of LOP being changed and the computer charge number. (L.S. number)
- 5) The Engineering Assistant's name and telephone number.

All material should be enclosed in a CRD envelope, clearly marked that it is LOP input and hand carried to the person currently handling the LOP processing in the computer room.

4.9 CHECKING OF OUTPUT

The Computer Department will print a single copy of the LOP (Christmas Tree and Work Copy) for the Engineering Assistant to use as a check copy. There

are two checks to be made:

- 1) Compare the LOP Output with the Input. If any errors are found, the Computer Department should be notified of the error, in which case, they will make the correction at no cost to the requesting department.
- 2) Compare the LOP Output with the ECO's. The LOP should then be checked against the approved ECO for any errors by the Engineering Assistant. If errors are found, the corrections should be given to the Computer Department and LOP rerun. In which case, the requester will be charged for the rerun.

If the check copy is correct, then the Computer Department should be notified so they may print the final distribution.

4.10 DISTRIBUTION

At the present, eighteen copies of the LOP are printed with twelve copies going to Material Control and the remaining six to Reactor Engineering Administration.

The Engineering Assistant distributes the six copies to the following people:

- 1) ECO Engineering Aide -- Reactor Engineering Administration
 - 2) ECO Writer -- Drafting Services
 - 3) Supervisor -- Drafting Checking
 - 4) Engineering Coordinator for that particular reactor
 - 5) Original
 - 6) Extra Copy
- } Kept by the Engineering Assistant

4.11 COST OF ISSUING

The cost of issuing the List of Parts is largely dependent upon the extent of the changes. However, over a span of approximately two years, the average time to process one complete run of the List of Parts (a single printing on six-ply

paper of the Christmas Tree and Work Copy) has been:

	<u>Avg Time-hrs</u>	<u>Rate \$/hr</u>	<u>Cost</u>
Computer	0.6	300.	180.
Peripheral	3.6	40.	144.
Key punch	6.0	4.50	<u>27</u>
		Total	\$351.
		Cost/Copy	\$58.

5. INPUT TECHNIQUE

5.1 INTRODUCTION

The previous chapter covered the scope and the necessary fundamentals of the LOP operation. Therefore, this chapter will describe in depth the topics mentioned previously as well as illustrating a number of special situations encountered in the maintenance of a LOP.

5.2 INPUT ORGANIZATION

Before actually starting to write the input, the ECO's should be grouped as much as possible into two categories:

- 1) Changes against the same assembly LOP.
- 2) Group changes for the same parts within each assembly LOP.

This sorting procedure will minimize any duplication of input through multiple entries since only the net result needs to be shown. An example of this is shown in the LOP section of three ECO's that follows:

<u>ECO</u>	<u>Component</u>	<u>Was</u>	<u>Quantity</u>	<u>Now</u>	<u>Quantity</u>
16,148	Bolt, Tie	Add	--	978D943H01A	42
16,157	Bolt, Tie	978D943H01A	42	978D943H02B	45
16,253	Bolt, Tie	978D943H02B	45	Delete	

By following the progression of the above ECO's, no input would be required since the net result is a deletion. Therefore, these ECO's would be set aside.

However, if we just had the first two ECO's (16,148 and 16,157), then the input would read as an Add:

<u>Component</u>	<u>Part No.</u>	<u>Quantity</u>
Bolt, Tie	978D943H02B	45

(The necessary address would also be added.)

In summary, the pattern of progression should be constructed before actually doing any writing.

5.2 INPUT WRITING

All input should be printed in standard capital letters with these exceptions:

letter O	-	Ø	the numeral 1	-	1
letter i	-	I	slash	-	/
letter z	-	Z			

When preparing the computer input form, use a regular sharp pencil.

When making changes on the Work Copy, use a red pen for clarity.

5.2.1 Abbreviations

Abbreviations are permitted as long as the meaning is not lost. Refer to earlier LOP's for examples of acceptable abbreviations.

5.2.2 Repeated Information

When lines of input are repeated, it is permissible and encouraged to draw an arrow line for these sections. Do not use ditto marks.

5.3 REACTOR AND ASSEMBLY CODE

Once the LOP has been initiated, these code numbers will not change unless the LOP structure changes. Therefore, it is simply a matter of recording the numbers used for a particular LOP in the Record Log book and referring to it as necessary.

5.4 SEQUENCE NUMBER

For each assembly LOP, any sequence number from 1 to 99,999 may be used. There are no hard, fast rules for sequencing. The general guide is "Leave enough space so that entries can be inserted where needed and without the necessity of resequencing." It is recommended that for the Filler Strip Assemblies and Cluster Assemblies a spacing of 500 be used between each assembly. For most other items, a spacing of 5 or 10 is adequate.

5.5 LEVEL CODE

The level code is very rarely specified by the ECO and must be selected by the Engineering Assistant. This is done by determining at what point in the assembly of the reactor this particular part is used. Many times it is necessary

to check the assembly drawing, layout drawing or with the engineer to determine this information. Since it is not uncommon for existing level codes to be lowered (B to C, etc., by adding a new subassembly drawing) the level code must be selected so that for every 'A' level, the ensuing string of lower level codes must be continuous: A, B, C, D, E, F, G. (G is lowest level code available in the present computer program.) It is advisable for the reader to refer back to chapter 2 where the function of the level code is fully explained.

5.6 PART DESCRIPTION

The part description is taken from the drawing title block and is listed in the LOP in the same manner, i.e., noun first, comma, modifier. By arranging the part description in noun sequence, it is possible to sort the LOP alphabetically by part description. This is useful as an index when part numbers are not known.

It is advisable to keep spacing between words at a minimum since this section is also used to show the following special ordering conditions:

- 1) Acceptable Items. When it is permissible to use a previous revision of the specified part number, this is shown in parenthesis beside the part description as follows:

<u>Part Description</u>	<u>Part Number</u>
Holder, Tie Rod (H05B Acc)	977D798H05C

In the above examples, the H05B Acc means that revision B of item 5 (H05) of the specified drawing number (977D798) is Acceptable (Acc) to use in substitution of Revision C.

- 2) Alternate Items. When another part number may be substituted for the prime part, this is shown through a combination of the level code and the part description. For example, if the prime part number for the Tie Bolt is 978D943H01A, and it is acceptable to use 978D446H01B, this would be shown in the following manner:

<u>LVL</u>	<u>Part Description</u>	<u>Part Number</u>	<u>Quantity</u>
B	Bolt, Tie (978D446H01 Alt)	978D943H01A	12
C	Alt for 978D943H01	978D446H01B	AR

(The level code here is an example. Any two consecutive level codes will work.)

- 3) Manufacturing "Holds". From time to time, it will be required to stop a part from being processed any further. This is accomplished by issuing an ECO and adding the work "HOLD" in the Part Description column as follows:

Part Description
Bolt, Tie (Hold)

5.7 PART NUMBER

The number being written should contain no spaces or dashes except those formally called for by the part number itself. Figure 5-1 shows the correct way in which the most common types of part numbers are written. Special attention should be made to the spacing of the type designated "item of assembly drawing", as this type is frequently used in the LOP. When encountering an unfamiliar type of part number, check the Work Copy to see if that type of number is presently being used. If that type of number is used, follow the same format. If that type of number is not used, it will be necessary to use good judgment in selecting the format.

If a given part number will not fit into the allotted twelve columns, such as a vendor's part number, then the item number of the assembly drawing bill of materials is used. Specifying part of the part number in the part description column should be avoided, since this method can lead to incorrect ordering information.

												Part Number											
												39	40	41	42	43	44	45	46	47	48	49	50
ASSEMBLY												9	3	8	J	4	6	5	G	0	1	A	
DETAIL												9	3	8	J	4	4	3	H	0	5	C	
ITEM OF ASSEMBLY DRAWING												9	3	8	J	4	6	5	IT		4		
MATERIAL SPECIFICATION												P	D	S	3	0	1	6	5	-	1		
INFORMATION DRAWING												9	5	7	A	7	8	4	C				
REFERENCE DRAWING												9	3	8	J	7	6	5	REF				

Figure 5-1 Part Number Format

5.8 QUANTITY

The computer program is written so that only numerical data will be accepted for quantities. Therefore, no letters or commas are permitted.

Frequently, an ECO will order a total quantity of a part and say only that the part is used in a number of specified assemblies. This requires the total quantity be broken down into how many are used for each assembly. It must be kept in mind that the quantity called for in each entry is the quantity required to build one of the next higher assembly. The quantity used per next higher assembly is found by checking the quantity on the assembly drawing bill of materials. It is also recommended that the reader refer to Section 3 where total quantity calculations are discussed.

A rule to follow when any total quantity must be broken down to respective assemblies is:

"The sum of the quantities in all assemblies must always equal the total quantity of the parts ordered."

Cases will also arise where there is a change in total quantity, but this new total quantity cannot be computed correctly until the quantities of the next higher assemblies are changed. For example, the number of washers might increase from 242 to 433, but since the washers are located within assemblies, the new total cannot be computed correctly. Until an ECO changing the higher assemblies is issued, an entry will have to be made called "Location Unassigned".

5.8.1 Location Unassigned

The entry "Location Unassigned" is an "A" level heading line placed at the end of that particular Assembly LOP. The items falling into this category are listed underneath starting at a "B" level. The following conditions usually require a "Location Unassigned" callout:

- 1) To balance a total quantity when the assemblies do not completely account for the quantity ordered. Referring to the above example of the increase in the washers, a line calling for 191 washers would be made as a "Location Unassigned" entry.

- 2) A part has been added to the LOP but has not been added to the assembly drawing.

It must be noted that these entries should be regarded as temporary since they exist only because of a lack of complete definition. The Engineering Assistant should follow through to see that these entries become clearly defined in the near future.

5.8.2 As Required Quantities

The "As Required" designation is used when the exact quantity of an item cannot be determined. Items such as cement, marking ink, braze lubrication, etc., fall into this category. An "As Required" quantity is specified by leaving the quantity column blank on the input sheet. The computer will automatically insert a "-0" in the quantity column and treat it as a zero for computational purposes. The entry is further identified by writing "(AR)" in columns 35-38 under the Part Description heading.

5.8.3 Supplemental Ordering Quantities

When an "As Required" quantity has been specified, we should, whenever possible, give an estimate as to how many may be required. This quantity is defined as a "Supplemental Ordering Quantity" (SOQ) and is listed as an "A" level entry at the end of that particular assembly LOP. The abbreviation SOQ is inserted in columns 34-38 under the Part Description heading. The jet orifices and the poison rods are typical SOQ items. The SOQ quantity will be used for ordering purposes.

5.9 ECO NUMBER

The ECO number inserted should be the number of the ECO authorizing the change or addition. In cases where entries must be rearranged or entire sections resequenced in order to accomplish the requirements of the ECO, the original ECO number for each effected entry should be kept rather than using the number of the ECO requiring the change. When writing the ECO number on the input form, the comma is used.

Example: Release Number
 12,534

5.10 OPERATION CODE

A special feature of the three basic operations is that a Delete and Add at the same address has the same effect as a change. This feature must be used when it is desired to change the address of existing information.

6. PREPARATION OF NEW LOP

6.1 INTRODUCTION

Sections 4 and 5 have dealt with the day-to-day problems of maintaining an existing LOP. This chapter will discuss how a new LOP is initially started and constructed.

6.2 DOCUMENTATION

The first step is to release the necessary paper work that provides other departments with the knowledge that a new LOP will be in existence. This information is provided by issuing an ECO formally releasing the LOP. The ECO should contain the following items:

6.2.1 Reactor Number

For each reactor, there are two official numbers assigned by Material Control: (1) the NERVA Directive Number, and (2) the build number. These two numbers designate the same reactor and are taken from the letter issued by Fiscal Control.

Examples are as follows:

<u>Build Number</u>	<u>NERVA Directive Number</u>
NRX-A6	ND-10601
NRX-A7	ND-10701

6.2.2 Reactor Code

The Reactor Code is a single digit number (zero through nine) that is substituted for the Reactor Number for computer purposes. Normally, the number picked is the same as the Reactor Number (NRX-A6 is a 6, NRX-A7 is a 7) although this is not a specific requirement. These numbers can be used over again if necessary since the tapes are not stored by this number.

6.2.3 Assembly Number

Since each reactor is broken down into major assemblies (Reactor, Shield, Reflector), standard WANL drawing numbers are assigned for each of the LOP's

for these major assemblies. Drawing numbers are used since the LOP is actually an assembly bill of materials and becomes part of the WANL drawing system. Revision letters are shown by starting with dash and continuing consecutively through the alphabet but omitting letters I, Ø, Q, and X.

6.2.4 Assembly Code

Next, a single digit number (zero through nine) is assigned for the Assembly Number for each of the LOP's.

The LOP numbers and Assembly Codes should then be listed on an ECO in an "organization chart" format. The major components of each assembly should be listed under the appropriate LOP Assembly Number. By presenting the information in this manner, LOP users can see how the various assembly LOP's fit together as well as where major components are located within the Lists of Parts.

6.3 COMPUTER SET UP

A copy of the ECO which releases the List of Parts should be taken to a Computer Technician working with the LOP. From this information, he will be able to establish the necessary tapes and be ready to receive the data.

6.4 INITIAL LOP

At the very beginning, the design releases will be few in number. The parts will be released on the basis of total quantity with no information as to how they will be broken down into subassemblies. Therefore, the items are listed in the LOP as single entries at an "A" level with no attempt made to construct or show the standard Christmas Tree LOP. At this point, the LOP will only be of a few pages, and will be a summary listing of the releases. Only total quantities will be shown.

6.5 CHRISTMAS TREE LOP

As the number and frequency of design releases increase, and the design of the end product starts to become firm, the Christmas Tree format is needed. The Christmas Tree LOP will clearly show what has been released, how the components fit into assemblies, and which items remain to be released. It is

advisable to prepare the Christmas Tree LOP while still using the Initial LOP in order to minimize delay and confusion in the transition. The transition is made by substituting the Christmas Tree LOP for the Initial LOP at the time of the next issuing. There are two methods in creating the Christmas Tree LOP:

- 1) LOP Duplication. If the reactor configuration is similar to a previous reactor, then the approach is this:
 - a) Take the tape from the previous LOP and duplicate this tape using the new reactor and assembly codes and deleting the part numbers and the ECO numbers. A "computer program" must be written in order to do this and it is usually handled by the Computer Department.
 - b) This runoff is then taken and updated to the new reactor definition. Also, at this point, any items already released should be added to their proper location. The Engineering Assistant should remember to check his total quantities making sure they are the same.
 - c) When this new runoff is checked and regarded correct, then this tape should replace the Initial LOP tape.
- 2) New LOP. If the new reactor configuration is completely different from any previous reactor, then the Christmas Tree LOP is written from scratch. This is done by using the layout drawing and meeting with the design engineers to establish the assembly configuration.

7. COMPONENT TEST LOP

7.1 CONSTRUCTION

The Component Test LOP provides a bill of material for each test to be performed or which has been completed. Active tests are segregated from inactive tests by printing the LOP in four sections:

- 1) Tests to be performed by Engineering Mechanics Laboratory
- 2) Tests completed by Engineering Mechanics Laboratory
- 3) Tests to be performed by Thermo Flow Laboratory
- 4) Tests completed by Thermo Flow Laboratory

A set of Component Test LOP's is maintained for each major reactor grouping (NRX/XE, NR, NE, etc.). Thus it serves in a support capacity in conjunction with the basic reactor LOP's.

7.2 FORMAT

The Component Test LOP uses the same computer program designed for the reactor LOP. A sample printout is shown in Figure 7-1. The printout varies from the reactor LOP because:

- 1) The Sequence Numbers (column 1) are assigned in blocks of 200 numbers, since experience shows this amount is ample to list the components for one test.
- 2) Only Level Codes A, B and C are used in the Component Test LOP. These are used for:

Level A	-	Test description, test identification number, and purpose of the test.
Level B	-	All component entries.
Level C	-	In-process parts, such as forgings, machining drawings for coated parts, etc.

This is for checking the effects of subsequent ECO's. In this manner, the test identification number appears in the NHA Part

Number column (column 6) in the Work Copy and readily shows where the components (Level B entries) are used. This is helpful since one part number may be specified for several different tests.

- 3) The NHA Quantity (column 5) is the total quantity required for a particular test.

(1) <u>Sequence Number</u>	(2) <u>Level</u>	(3) <u>Part Description</u>	(4) <u>Part Number</u>	(5) <u>Next Higher Assembly Quantity</u>	(6) <u>Part Number</u>	(7) <u>Release Number</u>
3000	A	Devel. Control Plate	EMLF4	1		
3002	A	Thermal Gradient	EMLF4	1		
3005	B	Control Plate Assy	977D791 G01B	1	EML F. 4	21000
3010	B	Plate	909E267 H01E	1	EML F. 4	21000
3015	B	Rivet	945C507 H01C	59	EML F. 4	21000
3020	B	Collar	963B090 H01C	59	EML F. 4	21000

Figure 7-1 Sample Component Test LOP Format

This is a development test. The test is to be run by the Engineering Mechanics Laboratory (EML) and the test identification number is EML F.4. The computer program requires that the NHA quantity column carry a number 1 for code level A input to provide a multiplier for calculation of group quantities for the work copy.

The purpose (sequence number 3002) of this test is to determine the effects of thermal gradients on the control plate.

Column 5 shows the quantity of each item required for this test.

7.3 WORK COPY

7.3.1 Part Number Sequence

The Work Copy repeats and rearranges the information from the LOP in part number sequence. This provides a check list against part number and quantity released for each test. In addition, it summarizes the total quantity released for all tests.

7.3.2 Format

The column headings are the same as those used on the reactor LOP Work Copy, but the information varies due to the changes described under "Format", paragraph 7.2 as shown in Figure 7-2.

(1) <u>Reactor Code</u>	(2) <u>Assy Code</u>	(3) <u>Seq Num</u>	(4) <u>Level</u>	(5) <u>Part Description</u>	(6) <u>Part Number</u>	(7) <u>NHA Qty</u>	(8) <u>Release Number</u>	(9) <u>Group Qty</u>	(10) <u>NHA Part Number</u>
0	1	3005	B	Control Plate Assy	977D791G01B	1	21000	1	EML F. 4
0	1	3505	B	Control Plate Assy	977D791G01B	3	21010	3	EML F. 6
NRX Active LOP. Total Entries = 2 For Part Number					977D791G01B. Total Required = 4				

Figure 7-2 Sample Component Test Work Copy Format

7.3.3 Reactor Code

The reactor code (column 1) must carry a digit for computer operation reasons. Since in this case it is a non-significant number, the digit zero was used.

7.3.4 Assembly Code

The assembly code (column 2) will be used to identify the four sections of the LOP described in paragraph A. Assigning different numbers to these sections will cause the Work Copy to be printed in four lists which will show the quantity of parts tested and the quantity of parts required to complete the remaining tests.

At the present time, the Assembly Codes for the Component Test Lists are:

		<u>Code</u>
NRX EML	Active	1
NR EML	Active	2
NRX-NR-EML	Completed	3
NRX-TFL	Active	4
NR-TFL	Active	5
NRX-NR TFL	Completed	6

7.3.5 Group Quantity

The group quantity (column 9) shows the quantity required for each test. The computer program calculates this quantity automatically.

7.3.6 NHA Part Number

The NHA part number (column 10) shows the test identification number. The computer program determines this automatically.

7.3.7 Total Required

The total required is shown at the bottom of the list and is the sum of the individual test requirements. Three control plate assemblies are required for a Thermal Bow Test EML F.6.

7.4 OPERATION

7.4.1 Updating Procedure

The Component Test LOP is usually updated on a monthly basis. However, the general guideline of revising the LOP whenever 15-20 ECO's have been approved also applies to the Component Test LOP. The techniques of collecting, sorting, and preparing the computer input data described in Section 5 also apply to the Component Test List of Parts.

7.4.2 Release Documents

The authorizing documents for the Component Test LOP are ECO's, Work Orders, and purchase requisitions. Some material and hardware for development tests are procured directly by Engineering. For these items, the purchase requisition or work order number should be inserted in the Release Number column of the Component Test LOP. As with ECO's, only approved purchase requisitions and work orders can be used as input to the Component Test LOP.

7.4.3 Active and Completed Lists

The Component Test LOP consists of both active and completed tests. The list of completed tests are kept for historical purposes, since this describes the hardware ordered for the test in detail. The Active list is, as the name implies, a list of hardware for tests which have not been conducted yet.

After the test hardware requirements have been satisfied (parts delivered or hardware obtained from Stores), the complete listing of hardware for the test should be transferred to the Completed list. It does not require an ECO to make this transfer. Periodically, the Engineering Assistant should check with the cognizant design engineers to determine which tests have been completed so the items can be transferred from the Active to the Completed list.

7.4.4 Process Part Definition

For certain components, it may be necessary to show the process part number as well as the finished product part number. Examples of this are forging drawings and machining drawings of coated parts. The process parts are listed as a Level Code C under the related component part number which is shown as a Level Code B. Care must be exercised in listing the NHA Quantity for the Level Code C parts. Normally, a quantity of one is shown (one forging required to make one finished part). Otherwise, the process part quantity will be multiplied by the Level Code B quantity, resulting in an excessive number of in-process parts.

7.4.5 Test Assembly Drawings

Although assembly drawings are seldom made for component tests, there is a specific method for listing these drawings in the Component Test LOP. The assembly drawing should be shown as a Level Code B entry and marked "reference" (REF) in the Part Description column, following the drawing title. The NHA Quantity is one.

All components shown on a test assembly drawing must be ordered individually and by total quantity required.

APPENDIX

SIBFTC LOP	LIST,REF,M94/2,XR7	
C	PROGRAM TO UPDATE LIST OF PARTS MASTER TAPE, PRINT ADD-CANCEL	0010
C	INFORMATION, AND PRINT REVISED LIST OF PARTS.	0020
	DIMENSION DATE(3),TDESCR(5),DESCRM(6),DESCRC(6)	0030
100	FORMAT(32H)CHANGES MADE TO LIST OF PARTS, .2A6,2H, .5A6,5H, AS ,	0040
1	28HISSUED BY REACTOR DESIGN ON .A2,1H/,A2,1H/,A2//9X,4HTHE ,	0050
2	59HFOLLOWING ITEMS ARE THOSE THAT HAVE BEEN REVISED, ADDED OR ,	0060
3	26HDELETED ON LIST OF PARTS, .2A6//17X,8HSEQUENCE,81X,	0070
4	7HRELEASE/18X,13HNUMBER LEVEL,8X,16HPART DESCRIPTION,11X,	0080
5	22HPART NUMBER QUANTITY,19X,6HNUMBER//)	0090
101	FORMAT(1H0,7X,11HADDITION = ,15,4X,A1,4X,5A6,3X,2A6,3X,15,3X,	0100
1	18HADDED PER ECO ,A6)	0110
102	FORMAT(1H0,7X,11HDELETION = ,15,4X,A1,4X,5A6,3X,2A6,3X,15,2X,	0120
1	19HDELETED PER ECO ,A6)	0130
103	FORMAT(1H0,12X,6HNOW = ,15,4X,A1,4X,5A6,3X,2A6,3X,15,11X,5HPER ,	0140
1	5HECO ,A6/13X,6HWA = ,15,4X,A1,4X,5A6,3X,2A6,3X,15,21X,A6)	0150
104	FORMAT(1H0,70X,5HPAGE ,I3)	0160
105	FORMAT(I2,I5,A1,7A6,I5,A6,A3,15X,I1)	0170
106	FORMAT(36H0ERROR IN LEVEL CODE, ENTRY READS = ,15,2X,A1,2X,5A6,2X,	0180
1	2A6,2X,2A6,2X,A6,2X,I5,2X,I5,2X,I1)	0190
107	FORMAT(22H0ERROR IN INPUT DATA, /15H ENTRY READS = ,12,2X,I5,2X,	
1	1A1,2X,5A6,2X,2A6,2X,I5,2X,A6,2X,I1)	
108	FORMAT(1H)	0220
110	FORMAT(1H1,6X,8HSEQUENCE,68X,31HNEXT HIGHER ASSEMBLY RELEASE/,	0230
1	8X,13HNUMBER LEVEL,9X,16HPART DESCRIPTION,21X,11HPART NUMBER,	0240
2	4X,32HQUANTITY PART NUMBER NUMBER//)	0250
111	FORMAT(9X,I5,4X,A1,4X,5A6,14X,2A6,5X,I5,19X,A6)	0260
112	FORMAT(9X,I5,4X,A1,6X,5A6,12X,2A6,5X,I5,4X,2A6,3X,A6)	0270
113	FORMAT(9X,I5,4X,A1,8X,5A6,10X,2A6,5X,I5,4X,2A6,3X,A6)	0280
114	FORMAT(9X,I5,4X,A1,10X,5A6,8X,2A6,5X,I5,4X,2A6,3X,A6)	0290
115	FORMAT(9X,I5,4X,A1,12X,5A6,6X,2A6,5X,I5,4X,2A6,3X,A6)	0300
116	FORMAT(9X,I5,4X,A1,14X,5A6,4X,2A6,5X,I5,4X,2A6,3X,A6)	0310
117	FORMAT(9X,I5,4X,A1,16X,5A6,2X,2A6,5X,I5,4X,2A6,3X,A6)	0320
118	FORMAT(1H0,60X,2A6//61X,13HLIST OF PARTS/52X,5A6//60X,7HISSUED ,	0330
1	A2,1H/,A2,1H/,A2/59X,17HBY REACTOR DESIGN//63X,5HPAGE ,I3)	0340
119	FORMAT(I2,I5,A1,5A6,A3,5A6,2I5,4A5,A1,3I1)	0350
120	FORMAT(I2,I5,A1,5A6,A3,2A6,12X,A6,2I5,4A5,A1,3I1)	0360
150	FORMAT(I2,3A2,7A6,7A1,23X)	0370
1	READ (5,150)ISSY,(DATE(I),I=1,3),TPN1,TPN2, (TDESC	0380
	1R(J),J=1,5),MA,MB,MC,MD,ME,MF,MG	0390
	WRITE (9,100)TPN1,TPN2,(TDESCR(J),J=1,5), (DATE(I)	0400
	1,I=1,3),TPN1,TPN2	0410
	WRITE (10,110)	0420
	NPC = 1	0430
	NPM = 1	0440
	KC = 1	0450
	KM = 1	0460

	JOBQTY = 1		0470
	IF (ISSY = 99) 10,2,10		0480
2	WRITE (11,119)ISSYM,ISFQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,PNM	0490
	12,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,A1,A2,A3,A4,AGFNT,	ICODEM,I	0500
	2S1,IS2		0510
	IF (ISEQM = 99999) 3,4,3		0520
3	READ (12,119)ISSYM,ISEQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,P	0530
	1NM2,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,A1,A2,A3,A4,AGFNT,	ICODEM	0540
	2,IS1,IS2		0550
	GO TO 2		0560
4	END FILE 9		0570
	END FILE 10		0580
	END FILE 11		0590
	REWIND 9		0600
	REWIND 10		0610
	REWIND 11		0620
	REWIND 12		0630
	CALL EXIT		0640
10	READ (12,119)ISSYM,ISEQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,P	0650
	1NM2,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,A1,A2,A3,A4,AGENT,	ICODEM	0660
	2,IS1,IS2		0670
	IF (ISSYM = ISSY) 11,19,2		0680
11	WRITE (11,119)ISSYM,ISEQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,PNM	0690
	12,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,A1,A2,A3,A4,AGFNT,	ICODEM,I	0700
	2S1,IS2		0710
	GO TO 10		0720
19	READ (5,105)ISSYC,ISFQC,LEVELC,(DESCRC(L),L=1,5),	PNC1,P	0730
	1NC2,IQIYC,ECOC,DESCRC(6),ICODEC		0740
20	IF (ISEQM = ISEQC) 21,40,40		0750
21	IF (LEVFLM = MD) 25,30,22		0760
22	IF (LEVFLM = ME) 28,31,23		0770
23	IF (LEVFLM = MF) 28,32,24		0780
24	IF (LEVFLM = MG) 28,33,28		0790
25	IF (LEVFLM = MC) 26,34,28		0800
26	IF (LEVFLM = MH) 27,35,28		0810
27	IF (LEVFLM = MA) 28,36,28		0820
28	WRITE (6,106)ISSYM,LEVFLM,(DESCRM(K),K=1,5),	PNM1,PNM	0830
	12,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,ICODEM		0840
	PRINT 106,(ISSYM,LEVFLM,(DESCRM(K),K=1,5),PNM1,PNM		
	12,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,ICODEM)		0840
29	READ (12,119)ISSYM,ISEQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,P	0850
	1NM2,NHPNM1,NHPNM2,ECOM,IQTYM,JQTYM,A1,A2,A3,A4,AGFNT,	ICODEM	0860
	2,IS1,IS2		0870
	IF (ISSYM = ISSY) 291,20,38		0880
291	IF (ICODEM = 0) 38,20,38		0890
30	JQTYD = IQTYM * JQIYC		0900
	WRITE (11,119)ISSYM,ISFQM,LEVFLM,(DESCRM(K),K=1,6),	PNM1,PNM	0910

12.HAPNC1,HAPNC2,FCOM,IQTYM,JQTYD,A1,A2,A3,A4,AGFNT,	ICODEM,I	0920
2S1,IS2		0930
WRITE (10,114)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	0940
12,IQTYM,HAPNC1,HAPNC2,ECOM		0950
HAPND1 = PNM1		0960
HAPND2 = PNM2		0970
GO TO 37		0980
31 JQTYE = IQTYM * JQTYD		0990
WRITE (11,119)ISSYM,ISEQM,LEVELM,(DESCRM(K),K=1,6),	PNM1,PNM	1000
12,HAPND1,HAPND2,ECOM,IQTYM,JQTYE,A1,A2,A3,A4,AGFNT,	ICODEM,I	1010
2S1,IS2		1020
WRITE (10,115)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1030
12,IQTYM,HAPND1,HAPND2,ECOM		1040
HAPNE1 = PNM1		1050
HAPNE2 = PNM2		1060
GO TO 37		1070
32 JQTYF = IQTYM * JQTYE		1080
WRITE (11,119)ISSYM,ISEQM,LEVELM,(DESCRM(K),K=1,6),	PNM1,PNM	1090
12,HAPNE1,HAPNE2,ECOM,IQTYM,JQTYF,A1,A2,A3,A4,AGFNT,	ICODEM,I	1100
2S1,IS2		1110
WRITE (10,116)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1120
12,IQTYM,HAPNE1,HAPNE2,ECOM		1130
HAPNF1 = PNM1		1140
HAPNF2 = PNM2		1150
GO TO 37		1160
33 JQTYG = IQTYM * JQTYF		1170
WRITE (11,119)ISSYM,ISEQM,LEVELM,(DESCRM(K),K=1,6),	PNM1,PNM	1180
12,HAPNF1,HAPNF2,ECOM,IQTYM,JQTYG,A1,A2,A3,A4,AGFNT,	ICODEM,I	1190
2S1,IS2		1200
WRITE (10,117)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1210
12,IQTYM,HAPNF1,HAPNF2,ECOM		1220
GO TO 37		1230
34 JQTYC = IQTYM * JQTYH		1240
WRITE (11,119)ISSYM,ISEQM,LEVELM,(DESCRM(K),K=1,6),	PNM1,PNM	1250
12,HAPNR1,HAPNR2,ECOM,IQTYM,JQTYC,A1,A2,A3,A4,AGFNT,	ICODEM,I	1260
2S1,IS2		1270
WRITE (10,113)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1280
12,IQTYM,HAPNR1,HAPNR2,ECOM		1290
HAPNC1 = PNM1		1300
HAPNC2 = PNM2		1310
GO TO 37		1320
35 JQTYH = IQTYM * JQTYA		1330
WRITE (11,119)ISSYM,ISEQM,LEVELM,(DESCRM(K),K=1,6),	PNM1,PNM	1340
12,HAPNA1,HAPNA2,FCOM,IQTYM,JQTYH,A1,A2,A3,A4,AGFNT,	ICODEM,I	1350
2S1,IS2		1360
WRITE (10,112)ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1370
12,IQTYM,HAPNA1,HAPNA2,ECOM		1380

	HAPNH1 = PNM1		1390
	HAPNH2 = PNM2		1400
	GO TO 37		1410
36	JQTYA = IQTYM * JOHRTY		1420
	WRITE (11,120) ISSYM, ISEQM, LEVELM, (DESCRM(K), K=1,6),	PNM1, PNM	1430
	12, ECOM, IQTYM, JQTYA, A1, A2, A3, A4, AGENT,	ICODEM, I	1440
	2S1, IS2		1450
	WRITE (10,111) ISEQM, LEVELM, (DESCRM(K), K=1,5),	PNM1, PNM	1460
	12, IQTYM, ECOM		1470
	HAPNA1 = PNM1		1480
	HAPNA2 = PNM2		1490
37	KM = KM + 1		1500
	IF (KM = 49) 29,60,29		1510
38	IF (ISEQC = 99999) 40,61,40		1520
40	IF (ICODEC = 1) 48,45,42		1530
42	IF (ICODEC = 2) 43,49,43		1540
43	WRITE (6,107) ISSYC, ISEQC, LEVELC, (DESCRC(L), L=1,5), PNC1, PNC		
	12, IQTYC, FCOC, ICODEC		1560
	PRINT 107, (ISSYC, ISEQC, LEVELC, (DESCRC(L), L=1,5), PNC1, PNC		
	12, IQTYC, FCOC, ICODEC)		
	GO TO 19		1570
44	WRITE (9,102) ISEQM, LEVELM, (DESCRM(K), K=1,5),	PNM1, PNM	1580
	12, IQTYM, FCOC		1590
	ICODEM = ICODEC		1600
	READ (5,105) ISSYC, ISEQC, LEVELC, (DESCRC(L), L=1,5),	PNC1, P	1610
	INC2, IQTYC, ECOC, DESCRC(6), ICODEC		1620
	KC = KC + 2		1630
	IF (KC = 52) 29,70,70		1640
45	WRITE (9,101) ISEQC, LFVELC, (DESCRC(L), L=1,5),	PNC1, PNC	1650
	12, IQTYC, FCOC		1660
	ICODEM = ICODEC		1670
	ISSYM = ISSYC		1680
	ISEQM = ISEQC		1690
	LEVELM = LFVELC		1700
	PNM1 = PNC1		1710
	PNM2 = PNC2		1720
	IQTYM = IQTYC		1730
	ECOM = FCOC		1740
	DATA 0000HL/6H /		1750
	AGENT = 0000HL		1760
	ICODEM = 0		1770
	A1 = 0000HL		1780
	A2 = 0000HL		1790
	A3 = 0000HL		1800
	A4 = 0000HL		1810
	IS1 = 0		1820
	IS2 = 0		1830

	DO 46 K = 1,6		1840
46	DESCRM(K) = DESCRC(K)		1850
47	KC = KC + 2		1860
	BACKSPACE 12		1870
	READ (5,105)ISSYC,ISFQC,LEVELC,(DESCRC(L),L=1,5),	PNC1,P	1880
	INC2,IQTYC,ECOC,DESCRC(6),ICODEC		1890
	IF (KC = 52) 21,70,70		1900
48	IF (ISFGM = ISEQC) 43,44,43		1910
49	IF (ISEQM = ISEQC) 43,50,43		1920
50	WRITE (9,103)ISEQC,LEVELC,(DESCRC(L),L=1,5),	PNC1,PNC	1930
	12,IQTYC,ECOC,ISEQM,LEVELM,(DESCRM(K),K=1,5),	PNM1,PNM	1940
	22,IQTYM,ECOM		1950
	ICODED = ICODEC		1960
	ISEQM = ISEQC		1970
	LEVELM = LEVELC		1980
	PNM1 = PNC1		1990
	PNM2 = PNC2		2000
	IQTYM = IQTYC		2010
	ECOM = FCOO		2020
	AGENT = Q000HL		2030
	A1 = Q000HL		2040
	A2 = Q000HL		2050
	A3 = Q000HL		2060
	A4 = Q000HL		2070
	IS1 = 0		2080
	IS2 = 0		2090
	DO 51 K = 1,6		2100
51	DESCRM(K) = DESCRC(K)		2110
52	KC = KC + 3		2120
	READ (5,105)ISSYC,ISFQC,LEVELC,(DESCRC(L),L=1,5),	PNC1,P	2130
	INC2,IQTYC,ECOC,DESCRC(6),ICODEC		2140
	IF (KC = 52) 21,70,70		2150
60	WRITE (10,118)TPN1,TPN2,(TDESCR(J),J=1,5),	(DATE(I)	2160
	1,I=1,3),NPM		2170
	WRITE (10,110)		2180
	NPM = NPM + 1		2190
	KM = 1		2200
	GO TO 29		2210
61	KPM = 44 - KM		2220
	DO 62 I = 1,KPM		2230
62	WRITE (10,108)		2240
63	WRITE (10,118)TPN1,TPN2,(TDESCR(J),J=1,5),	(DATE(I)	2250
	1,I=1,3),NPM		2260
	BACKSPACE 12		2270
64	KPC = 52 - KC		2280
	DO 65 I = 1,KPC		2290
65	WRITE (9,104)		2300

66	WRITE (9,104)NPC	2310
	GO TO 1	2320
70	WRITE (9,104)NPC	2330
	WRITE (9,100)TPN1,TPN2,(TODESCR(J),J=1,5),	(DATE(I) 2340
	1,I=1,3),TPN1,TPN2	2350
	NPC = NPC + 1	2360
	KC = 1	2370
	IF (ICODED - 0) 21,29,21	2380
	END	2390

\$IRSYS

\$REMOVE SYSUT5

\$REMOVE SYSUT6

\$JOB

\$* SORT B5, OUTPUT A5 SORT FOR WORK COPY

\$* ALL TAPE UNITS MUST BE IN READY STATUS FOR THE FOLLOWING RUN

\$* PRESS START WHEN ALL TAPE UNITS ARE READY

\$PAUSE

\$RELEASE SYSUT1

\$RELEASE SYSUT2

\$RELEASE SYSUT3

\$RELEASE SYSUT6

\$RELEASE SYSUT7

\$RELEASE SYSUT5

\$ATTACH R2

\$AS SYSCK2

\$EXECUTE SORT

FIL, INP/111, MODE/D, DENS/H, BLOCK/1A

FIL, OUT, MODE/D, DENS/H, BLOCK/1A

REC, TYP/F, LEN/1A, FIELDS/(2,39,12,49,1,2)

SORT, FIL/111, SEQ/C, ORDER/2, FIELDS/(5,3,1)

CHAN, INP/B, MERGE/(A,B), OUTPUT/A

OPTION, NOCKPT, EQUALS

END

\$IRSYS

\$IRFTC WCOPY LIST,REF,M94/2,XR7

C PROGRAM TO OBTAIN LIST OF PARTS TOTALS PER PART NUMBER

DIMENSION DATE(3),DESCR(5)

100 FORMAT(1H1,15X,A6,43H LIST OF PARTS TOTAL REQUIREMENTS PER PART ,

1 17HNUMBER AS OF ,3A6//19H REACTR ASSY SEQ,56X,3HNHA,4X,

2 7HRELEASE,8X,5HGROUP,7X,3HNHA/26H CODE CODE NUM LEVEL,7X,

3 17HPART DESCRIPTION,10X,11HPART NUMBER,4X,3HWTY,4X,6HNUMBER,

4 7X,21HQUANTITY PART NUMBER//)

101 FORMAT(17H CORE SUBASSEMBLY,6X,16HTOTAL ENTRIES = ,13,2X,4HFOR ,

1 17HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)

102 FORMAT(14H CORE ASSEMBLY,9X,16HTOTAL ENTRIES = ,13,2X,9HFOR PART ,

1 7HNUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)

103 FORMAT(39H OUTER REFLECTOR ASSY TOTAL ENTRIES = ,13,2X,4HFOR ,

0010

0020

0030

0040

0050

0060

0070

0080

0090

0100

0110

0120

	1	12HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0130
104		FORMAT(17H REACTOR ASSEMBLY,6X,16HTOTAL ENTRIES = ,13,2X,4HFOR ,	0140
	1	12HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0150
105		FORMAT(16H SHIELD ASSEMBLY,7X,16HTOTAL ENTRIES = ,13,2X,4HFOR ,	0160
	1	12HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0170
106		FORMAT(1X,A6,9H ASSEMBLY,7X,16HTOTAL ENTRIES = ,13,2X,9HFOR PART ,	0180
	1	7HNUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0190
107		FORMAT(12H0TOTALS FOR ,A6,4X,16HTOTAL ENTRIES = ,14,2X,8HFOR PART,	0200
	1	8H NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15//)	0210
108		FORMAT(1H)	0220
109		FORMAT(1H0,75X,5HPAGE ,13)	0230
110		FORMAT(4A6,56X)	0240
111		FORMAT(2I1,15,A1,5A6,3X,5A6,2I5,2IX,3I1)	0250
112		FORMAT(4X,I1,5X,I1,4X,I5,3X,A1,4X,5A6,2X,2A6,2X,I5,3X,A6,9X,I5,3X,	0260
	1	2A6)	0270
113		FORMAT(39H LIST OF SPICAL PARTS TOTAL ENTRIES = ,13,2X,4HFOR ,	0280
	1	12HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0290
114		FORMAT(39H FUEL ELEMENT LOCATION TOTAL ENTRIES = ,14,1X,4HFOR ,	0300
	1	12HPART NUMBER ,2A6,8X,17HTOTAL REQUIRED = ,15)	0310
		K = 1	0320
		NP = 1	0330
		ICT = 0	0340
		ITOT = 0	0350
		JCT = 0	0360
		JTOT = 0	0370
		READ (5,110) (DATE(I),I=1,3),ASSY	0380
		WRITE (10,100) ASSY, (DATE(I),I=1,3)	0390
		READ (4,111) IMAJ, IASSY, ISEQ, LEVEL, (DFSCR(J), J=1,5), IPN1, IPN2, N	0400
		1HAPN1, NHAPN2, ECO, IQTY, JQTY, ICODE, I2, I3	0410
1		WRITE (10,112) IMAJ, IASSY, ISEQ, LEVEL, (DESCR(J), J=1,5), IPN1, IPN	0420
		12, IQTY, ECO, JQTY, NHAPN1, NHAPN2	0430
		ICT = ICT + 1	0440
		JCT = JCT + 1	0450
		ITOT = ITOT + JQTY	0460
		JTOT = JTOT + JQTY	0470
		JASSY = IASSY	0480
		JPN1 = IPN1	0490
		JPN2 = IPN2	0500
		K = K + 1	0510
		IF (K = 54) 2,30,30	0520
2		READ (4,111) IMAJ, IASSY, ISEQ, LEVEL, (DFSCR(J), J=1,5), IPN1, IPN2, N	0530
		1HAPN1, NHAPN2, ECO, IQTY, JQTY, ICODE, I2, I3	0540
		IF (ICODF = 0) 40,3,40	0550
3		IF (IPN1 = JPN1) 6,4,6	0560
4		IF (IPN2 = JPN2) 6,5,6	0570
5		IF (IASSY = JASSY) 6,1,6	0580
6		IF (JASSY = 2) 7,6,9	0590

7	WRITE (10,101) ICT, JPN1, JPN2, ITOT	0600
	GO TO 20	0610
8	WRITE (10,102) ICT, JPN1, JPN2, ITOT	0620
	GO TO 20	0630
9	IF (JASSY = 4) 10,11,12	0640
10	WRITE (10,103) ICT, JPN1, JPN2, ITOT	0650
	GO TO 20	0660
11	WRITE (10,104) ICT, JPN1, JPN2, ITOT	0670
	GO TO 20	0680
12	IF (JASSY = 6) 13,14,15	0690
13	WRITE (10,105) ICT, JPN1, JPN2, ITOT	0700
	GO TO 20	0710
14	WRITE (10,106) ASSY, ICT, JPN1, JPN2, ITOT	0720
	GO TO 20	0730
15	IF (JASSY = 8) 16,17,17	0740
16	WRITE (10,113) ICT, JPN1, JPN2, ITOT	0750
	GO TO 20	0760
17	WRITE (10,114) ICT, JPN1, JPN2, ITOT	0770
20	ICT = 0	0780
	ITOT = 0	0790
	K = K + 1	0800
	IF (K = 54) 21,30,30	0810
21	IF (IPN1 = JPN1) 23,22,23	0820
22	IF (IPN2 = JPN2) 23,1,23	0830
23	WRITE (10,107) ASSY, JCT, JPN1, JPN2, JTOT	0840
	JCT = 0	0850
	JTOT = 0	0860
	K = K + 3	0870
	IF (K = 54) 1,30,30	0880
30	WRITE (10,109) NP	0890
	WRITE (10,100) ASSY, (DATE(I), I=1,3)	0900
	NP = NP + 1	0910
	K = 1	0920
	IF (ICT = 0) 2,31,2	0930
31	IF (JCT = 0) 21,1,21	0940
40	IF (JASSY = 2) 41,42,43	0950
41	WRITE (10,101) ICT, JPN1, JPN2, ITOT	0960
	K = K + 1	0970
	GO TO 50	0980
42	WRITE (10,102) ICT, JPN1, JPN2, ITOT	0990
	K = K + 1	1000
	GO TO 50	1010
43	IF (JASSY = 4) 44,45,46	1020
44	WRITE (10,103) ICT, JPN1, JPN2, ITOT	1030
	K = K + 1	1040
	GO TO 50	1050
45	WRITE (10,104) ICT, JPN1, JPN2, ITOT	1060

	K = K + 1	1070
	GO TO 50	1080
46	IF (JASSY - 6) 47,48,49	1090
47	WRITE (10,105) ICT,JPN1,JPN2,ITOT	1100
	K = K + 1	1110
	GO TO 50	1120
48	WRITE (10,106) ASSY,ICT,JPN1,JPN2,ITOT	1130
	K = K + 1	1140
	GO TO 50	1150
49	IF (JASSY-8) 54,55,55	1160
54	WRITE (10,113) ICT,JPN1,JPN2,ITOT	1170
	K = K + 1	1180
	GO TO 50	1190
55	WRITE (10,114) ICT,JPN1,JPN2,ITOT	1200
	K = K + 1	1210
50	WRITE (10,107) ASSY,JCT,JPN1,JPN2,JTOT	1220
	K = K + 3	1230
51	KP = 54 - K	1240
	DO 52 I = 1,KP	1250
52	WRITE (10,108)	1260
53	WRITE (10,109) NP	1270
	REWIND 9	1280
	END FILE 10	1290
	REWIND 10	1300
	CALL EXIT	1310
	END	1320

REFERENCE