

VGB PowerTech

KKS-Application Commentaries

**Part B Engineering
 Discipline-Specific**

**Part B1 Identification in
 Mechanical
 Engineering**

KKS- Identification System for Power Stations

VGB-B 106 B1 E

Edition

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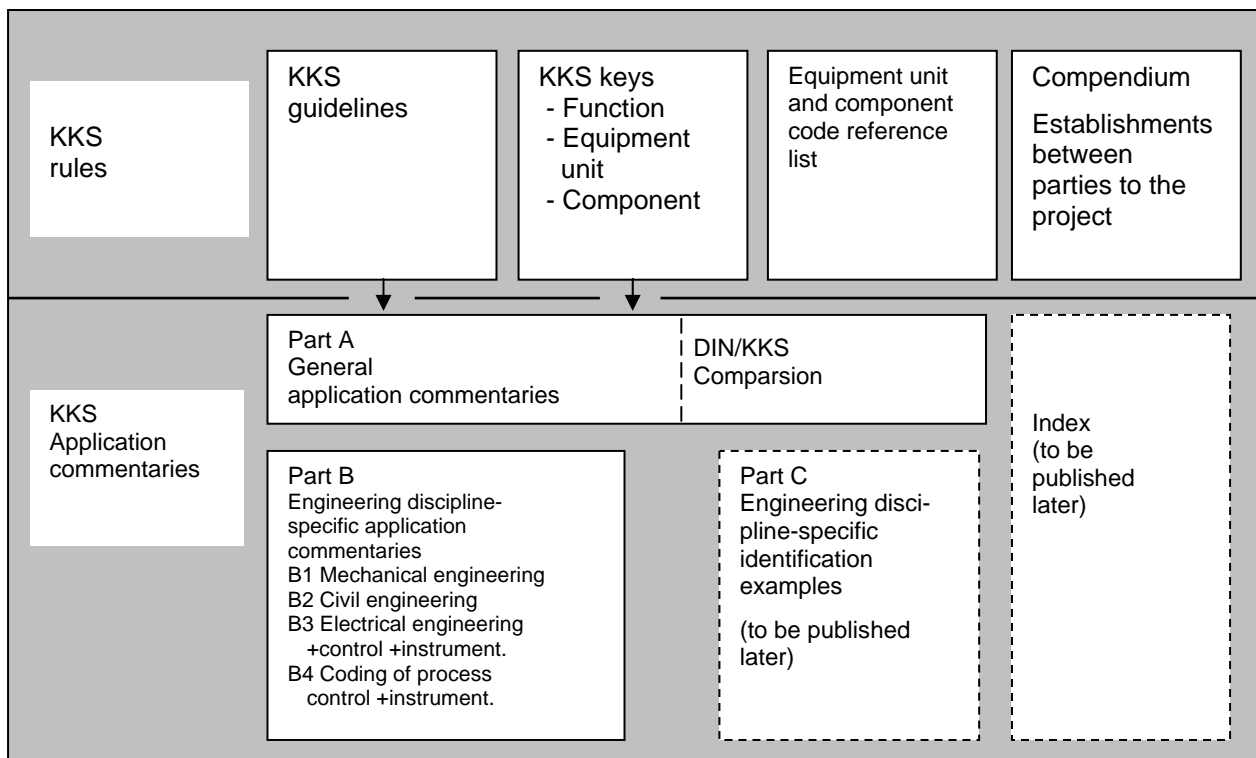


Preface to the KKS Application Commentaries

The response to the 2nd edition of the Identification System for Power Stations (KKS) which was published in 1983 shows that the KKS is finding ever increasing use both at home and abroad in the planning, construction and operation of power plants. KKS fulfils its function as "accepted engineering practice". It must, however, be used correctly in order to ensure unique identification and rational work methods. Consequently the VGB Technical Committee on Technical Classification Systems, which has taken over the duties of the previous KKS Steering Committee, resolved to support the use of KKS by publishing commentaries on its application.

The Application Commentaries are supplements to the KKS Guidelines and are intended to give assistance in use of the identification system.

The diagram below shows the relationships between the KKS Rules and KKS Application Commentaries:



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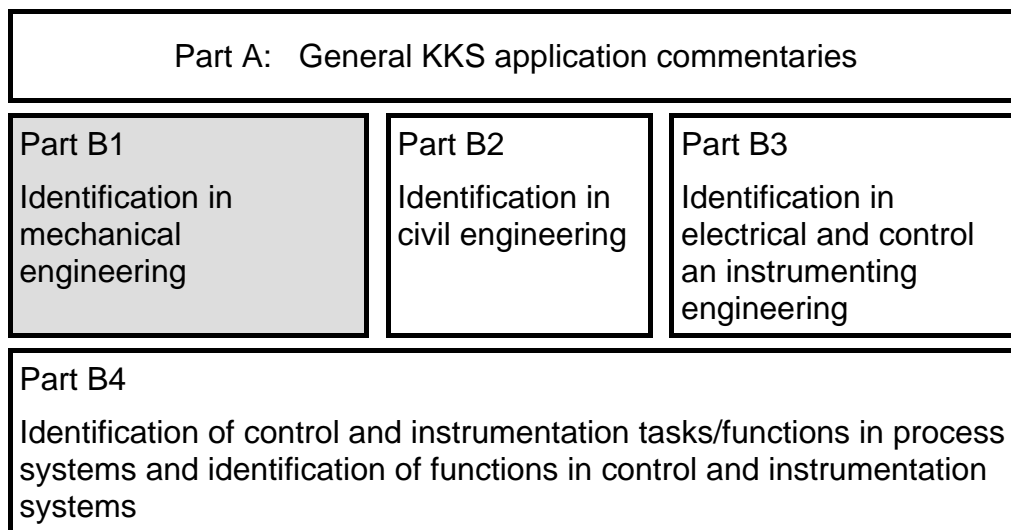
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1 Structure and Fields of Application

The Application Commentaries show the many possible ways of using KKS to fulfil the various identification requirements of the engineering disciplines. The Application Commentaries are also structured in keeping with these requirements.

The Application Commentaries, which give examples on the use of KKS, contain detailed descriptions for the various engineering disciplines and are subdivided as follows:

- Part A: General KKS application commentaries
- Part B: Engineering discipline-specific application commentaries
 - Part B1: Identification in mechanical engineering
 - Part B2: Identification in civil engineering
 - Part B3: Identification in electrical and control and instrumentation engineering
 - Part B4: Identification of control and instrumentation tasks/functions in process systems and identification of functions in control and instrumentation systems
- Part C: Engineering discipline-specific identification examples



The present Part B₁ comments on engineering discipline-specific applications in mechanical engineering. Commentaries on and examples of application which are common to all engineering disciplines are contained in Part A and are not repeated in the engineering discipline-specific parts.

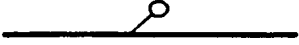

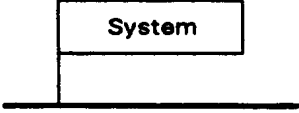
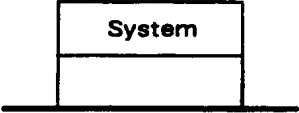
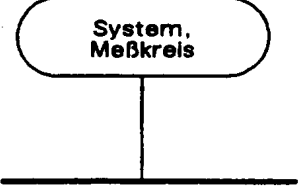
The examples given herein are recommendations; users should transfer them in spirit to their identification needs.

The parties to the project may use different symbols (e.g. for system interfaces) and

different notations of codes in documents.

The mode of representation and notation of the codes and the symbols selected are not generally binding and are subject to agreement between the parties to the project.

The following test uses the symbols shown below.

Symbol	Explanatory remarks
	The 'pin with empty pinhead' represents interfaces between system/plants and subsystems/plant sections.
	The 'pin with full pinhead' represents interfaces between piping subsystems.
	The 'flag' symbol represents codes for piping. The flag points in the direction of fluid flow.
	The extended 'flag' symbol represents codes for piping in which the direction of fluid flow changes according to mode the operation.
	The 'C & I loop' symbol represents measuring circuits.

2 Format of Process-Related Code

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	(A or N)	(N) A A A N N	A A N N N (A)	A A N N

Prefix symbol

for process -related code

Prefix number for system code

Numbering of similar systems and plants in the parts of a power station identified on breakdown level 0

System classification

Classification of systems and plants as per KKS Key

System numbering

Numbering subdivision of systems and plants into subsystems and sections of plants

Equipment unit classification

Classification of mechanical equipment, electrical and control and instrumentation equipment as per KKS Key

Equipment unit numbering

Numbering of mechanical equipment, electrical and control and instrumentation equipment

Additional code

for the equipment unit code

Component classification

Classification of components, signals or signal applications as per KKS Key

Component numbering

Numbering of components, signals or signal applications

The data characters in parentheses () may be omitted if the code remains unique. This has to be specified between the parties to the project.

3 Contents of Data Characters

The codes used on breakdown level 0 and for the prefix number F_0 of breakdown level 1 have no effect on the systematics of identification in the other data characters and are therefore not dealt with in Part B1. Comments on application are contained in Part A.

3.1 Breakdown Level 1, System Code

In mechanical engineering the system code subdivides the total plant into systems and plants. The system code consists of the prefix number F_0 and of system classification and numbering elements.

3.1.1 System Classification

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F_0 F_1 F_2 F_3 F_N	A_1 A_2 A_N A_3	B_1 B_2 B_N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

System classification

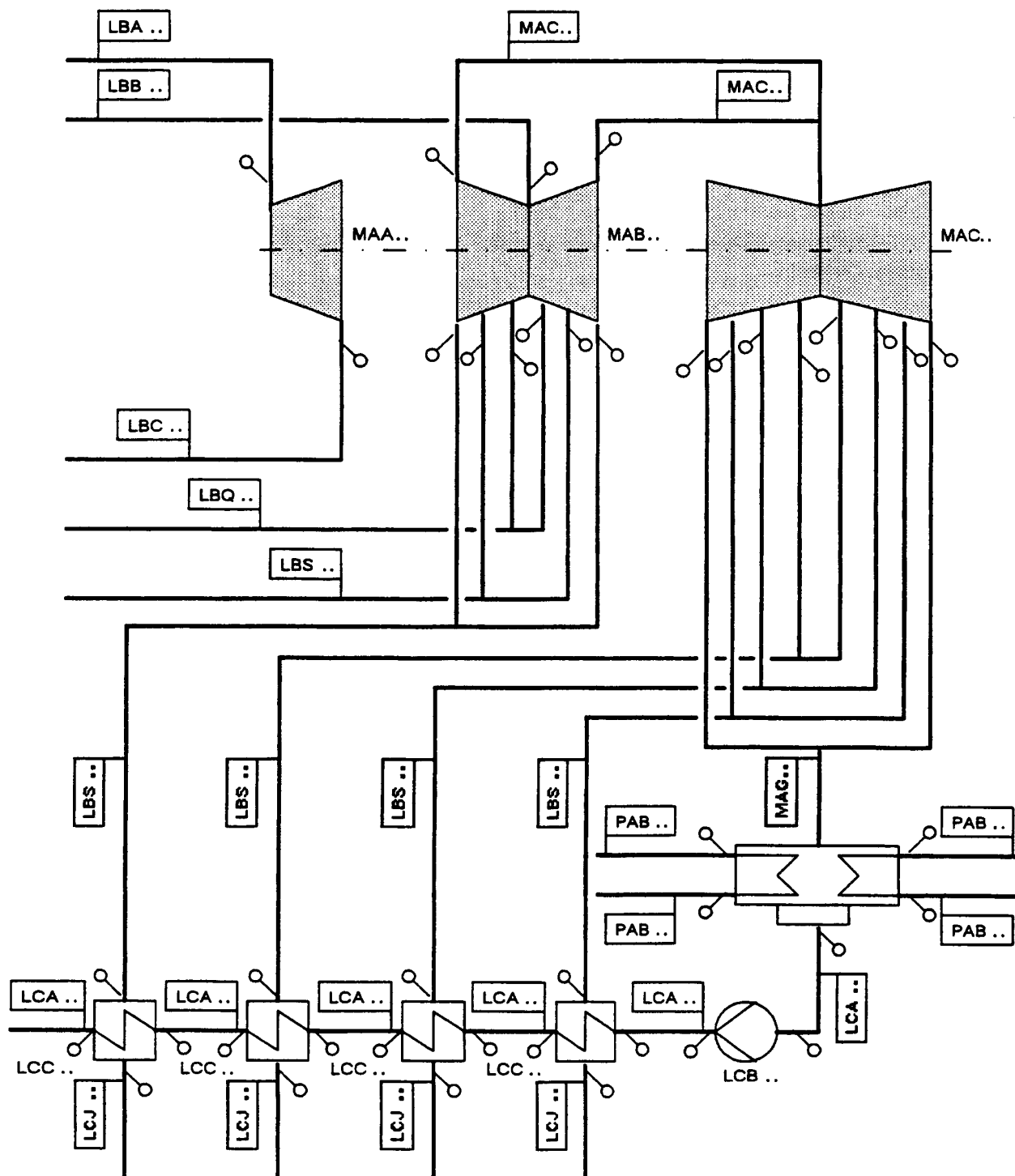
Classification of systems and plants as per KKS Key

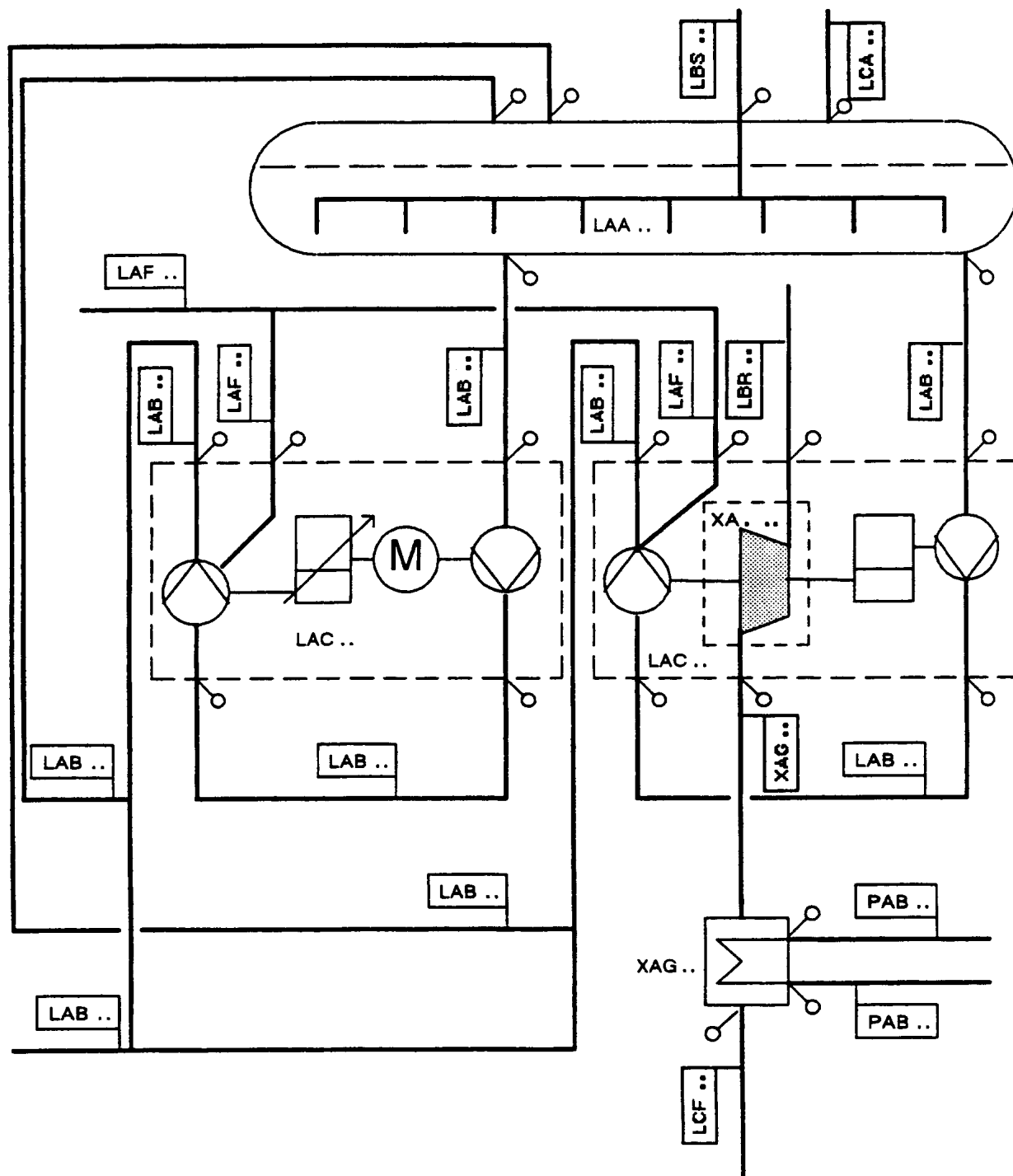
Coding letters and designations of the main groups F_1 as given in the Function Key:

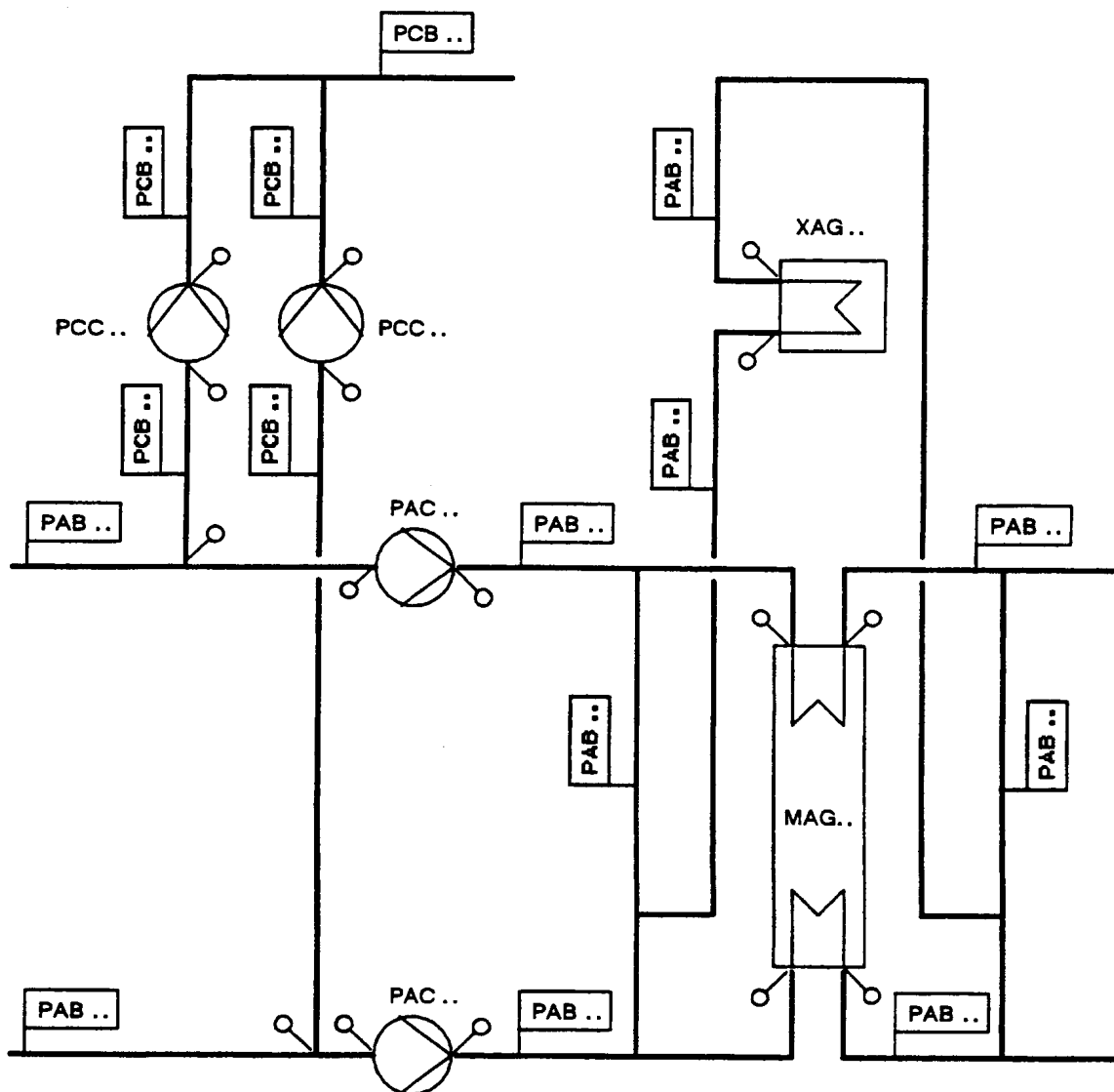
E	Conventional fuel supply and residues disposal
F	Handling of nuclear equipment
G	Water supply and disposal
H	Conventional heat generation
J	Nuclear heat generation
K	Nuclear auxiliary system
L	Water, steam, gas cycle
M	Main machine set
N	Process energy supply for external users (e.g. district heating)
P	Cooling water system
Q	Auxiliary system
R	Gas generation and treatment
S	Ancillary system
U	Structure
X	Heavy machinery
Z	Workshop and office equipment

The subdivisions in F_2 and F_3 are given in the applicable Function Key.

Example 1: Section of steam/water cycle showing system interfaces



Example 2: Section of feedwater system showing system interfaces

Example 3: Section of circulating water systems showing system interfaces

3.1.1.1 "Components" Requiring Many Identification Details

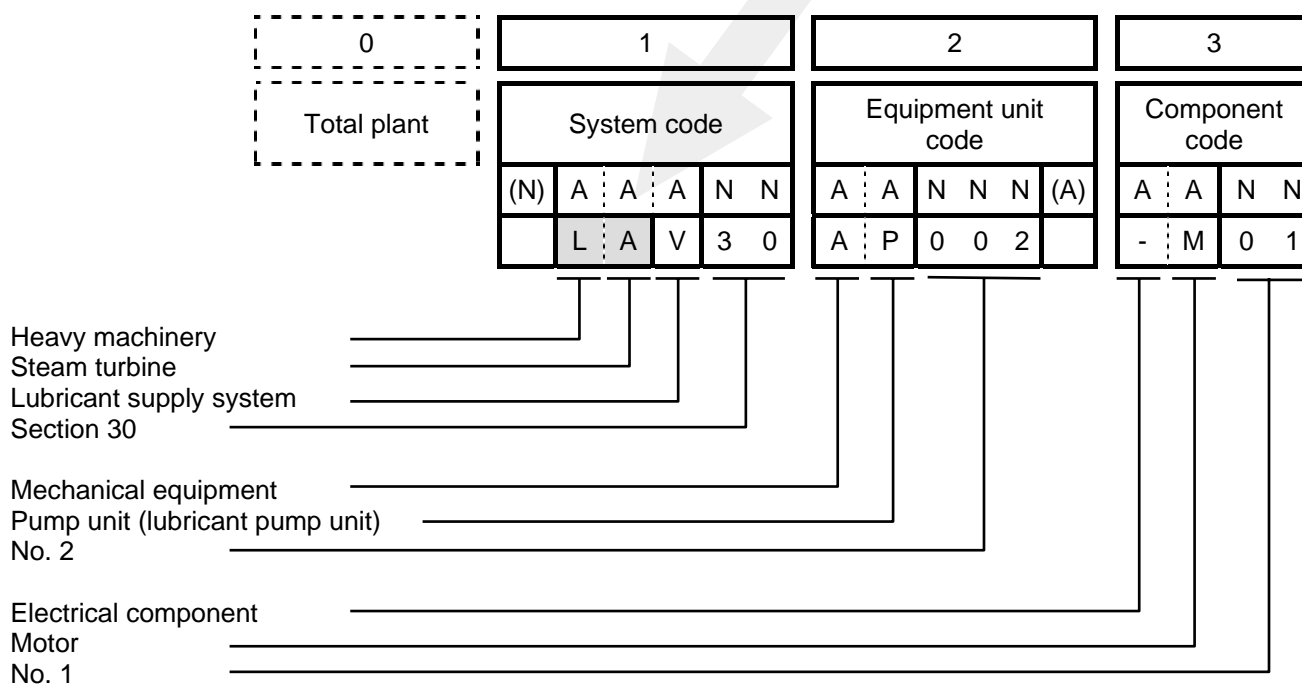
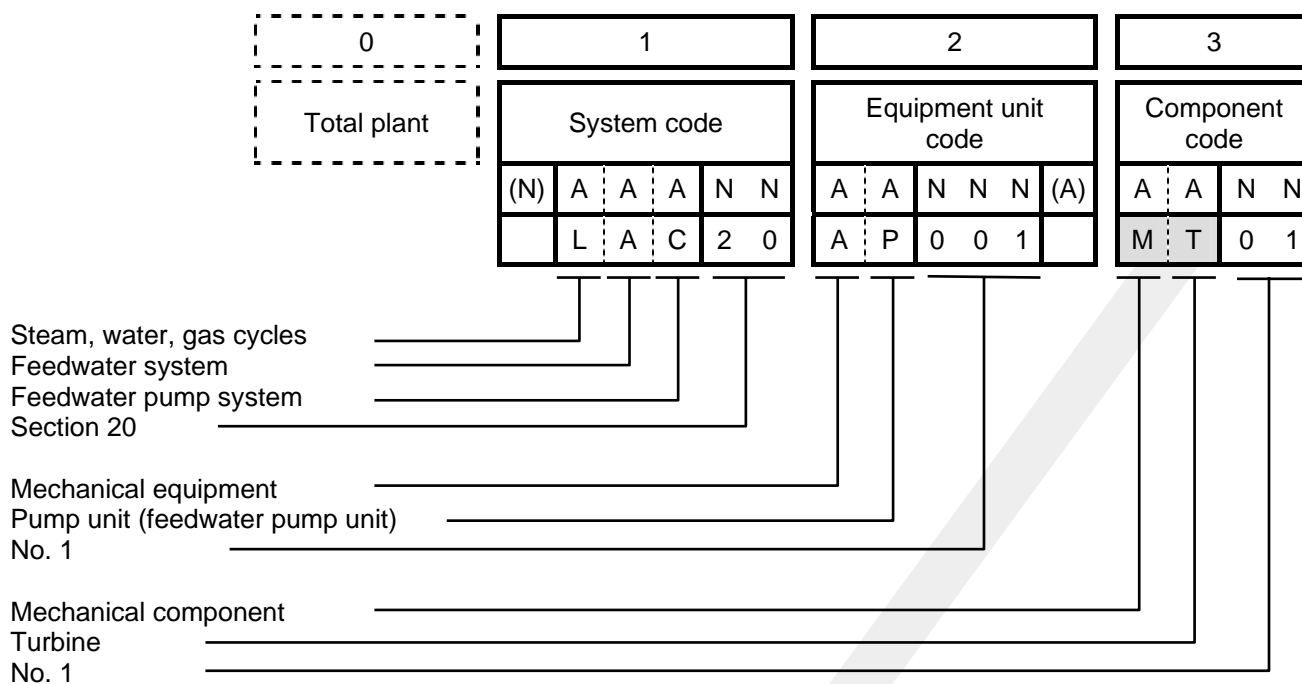
Some "components" such as heat exchangers, vessels and pumps, require so many identification details that they require separate system codes F_1 F_2 F_3 to permit identification of the associated mechanical equipment and electrical and control and instrumentation equipment.

Examples are:

EGB	Tank farm
ETH	Storage system for dry ash
GAD	Storage system for raw water extraction
GNJ	Preheating, cooling system for treatment of process drains
HLD	Air heating system (flue-gas-heated)
JAA	Reactor vessel
JEA	Reactor coolant heat exchanger
JFD	Moderator heat exchanger
LAA	Storage, deaeration in feedwater system
LAC	Feedwater pump system
LCC	LP feedwater heating system
PAC	Circulating water pump system
PCC	Pump system in service water system for conventional area
MAG	Condensing system

Also "components" such as steam turbines used to drive feedwater pumps require so many identification details that, as "heavy machinery", they too need separate system codes in order to permit identification of all associated mechanical, electrical and control and instrumentation equipment. The system codes for such heavy machinery are stipulated in main group F_1 as X.

The following diagram shows how the "component" MT = turbine used to drive a feedwater pump unit becomes heavy machinery XA = steam turbine plant in order to permit complete identification of its lube oil supply system XAV.



3.1.1.2 Heat Exchangers

On account of their functions heat exchangers are parts of two systems, namely of

- the system containing the heat-rejecting fluid

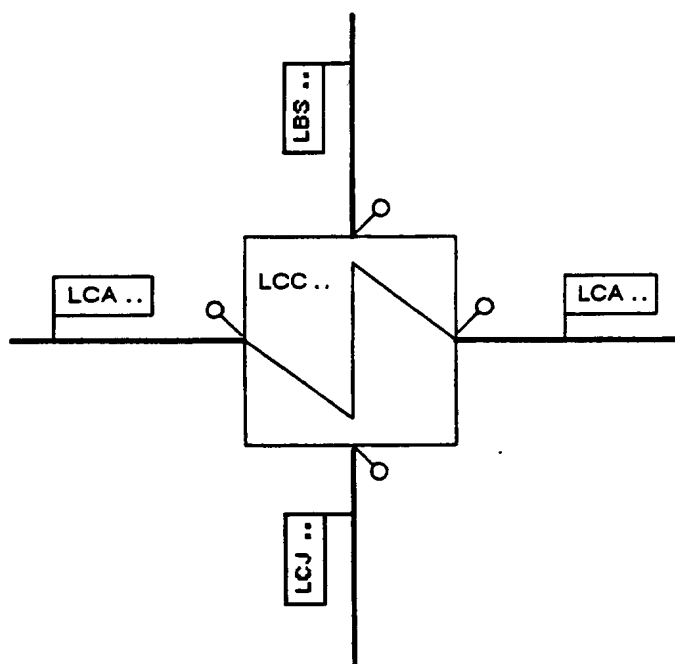
and

- the system containing the heat-absorbing fluid.

From the identification standpoint, however, a heat exchanger may only be considered part of one system. It is assigned a code according to the originator principle, i.e. according to the mechanical system whose functions require the heat exchanger. This originator principle is observed in the designations and interfaces for feed heaters classified in the Function Key.

Example 4: LP feedwater heater

The LP feedwater heater is functionally required by main condensate. It receives its code from the main condensate system LC.



3.1.1.3 Supply Systems

Mechanical supply systems can be used for groups of users of very different sizes. They can serve:

Fall 1:	several main groups	F_1
Fall 2:	several groups	F_2
Fall 3:	several subgroups	F_3
Fall 4:	one subgroup only	F_3

The following identification rules apply to the individual applications:

- Case 1:
Supply systems as separate auxiliary and ancillary systems for several main groups F_1 :
Mechanical supply systems which serve more than one main group F_1 are identified as auxiliary or ancillary systems in separate main groups F_1 by means of the following coding letters:

- G** for water supply and disposal
- K** for reactor auxiliary systems
- Q** for auxiliary systems
- S** for ancillary systems

Example 5: Separate auxiliary and ancillary systems

Case	User (system)		Supply system	
1	L..	Steam, water, gas cycles	Q..	Auxiliary system
	M..	Main machine sets		

- Cases 2 and 3:

Supply systems for several groups F_2 and subgroups F_3 :

Where a mechanical supply system serves more than one mechanical user system identified in:

$F_1 F_2$ (Case 2) or

$F_1 F_2 F_3$ (Case 3),

the following coding letters are used in the pertinent data characters of the system code for supply systems as follows:

V for lubricant supply system

W for sealing fluid supply system

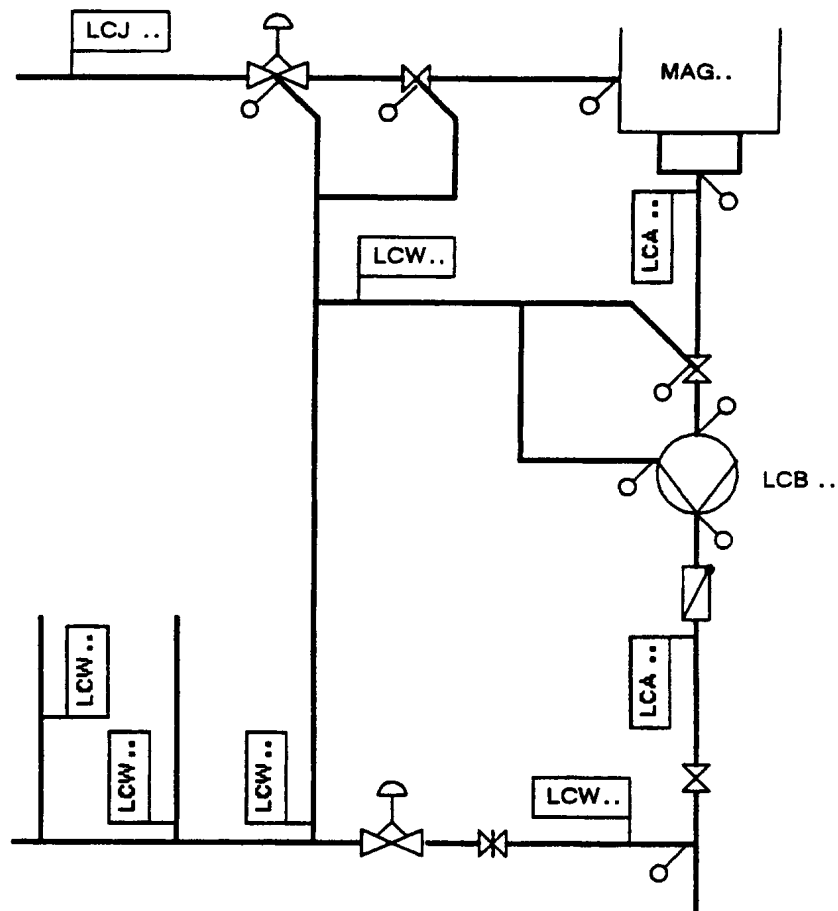
X for fluid supply system for control and protection equipment

In case 2 the applicable coding letter is therefore entered in data character F_2 with the possibility of using A to Z in F_3 for further subdivision. In case 3 the coding letter appears located in F_3 only.

Where these coding letters are not designated in the Key, they may be reserved subject to agreement between the parties to the project

Example 6: Sealing fluid supply system

Case	User (system)		Supply system	
2	LA .	Feedwater system	LW .	Sealing fluid supply system for steam, water, gas cycles
	LB .	Steam system		
	LC .	Condensate system		
3	LAB	Feedwater piping system	LAW	Feedwater sealing water system
	LAG	Feedwater pump system		
	LAD	HP feedwater heating system		

Example 7 (re case 3): Sealing and cooling drains system

- Case 4:
Dedicated supply systems for certain user systems identified as subgroups:

Where a system or plant identified in F_3 is served by a self-contained dedicated supply system, the supply system receives the same system code F_3 as the user (system or plant). Distinctions are made between the user system and the supply system in the numbering code element F_N (see Section 3.1.2).

Example 8: Lubricant supply system

Case	User (system)		Supply system	
4	LAC20	Feedwater pump system No. 2	LAC21	Lube oil system for feedwater pump system No. 2

3.1.1.4 Fluid Treatment Systems

A standard identification scheme has been established for the treatment and processing of supply and system fluids. This scheme classifies in F_3 of breakdown level 1 the physical

and chemical processes which may be present in treatment systems. The scheme applies to all fluid treatment and processing systems identified in data character F_2 regardless of the fluid handled and the process sequence of the treatment system concerned.

This fixed classification scheme ensures that systems which feature comparable processes are identified in F_3 by means of the same letters. Of all the codes provided under this non-application-specific maximum-scope scheme only those items which are present as systems in the plant concerned are actually used for identification. However, this is subject to agreement between the parties to the project.

Example 9: Injection systems

GBQ Injection system for water supply and disposal

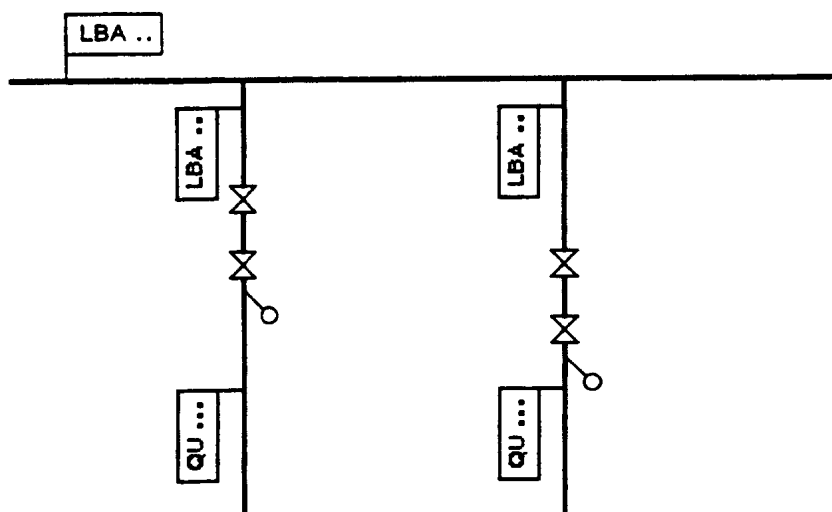
GNQ Injection system for process drains treatment

LDQ Injection system for condensate polishing

3.1.1.5 Sampling and Proportioning Systems

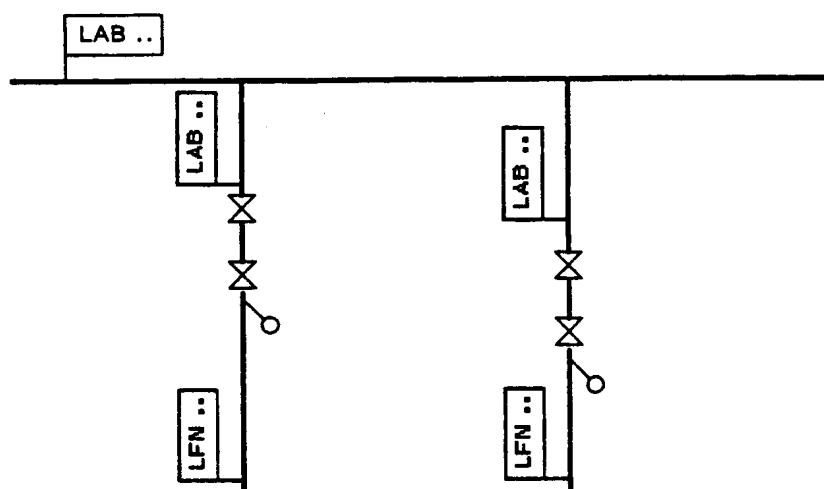
Sampling lines are assigned as far as the discharge into the sampling system to the system or plant to which they are connected. The sampling system, which is identified as a subgroup F_3 of the system code, starts downstream of the isolation element.

Example 10: Sampling lines for main steam piping system



Proportioning piping is assigned to the receiving system or plant from the discharge into that system or plant. The terminal of the proportioning system, which is identified as a subgroup F_3 of the system code, is upstream of the first isolation element of the supplied system.

Example 11: Proportioning lines for feedwater piping system



3.1.2 System Numbering

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

System numbering

Numbering subdivision of systems and plants into subsystems and sections of plants

Numbering starts anew when one of the preceding code elements changes. The F_N code element has no generally-applicable classifications. Redundant zeros must be written. Details of application to be specified between the parties to the project.

Generally valid rules on the use of F_N numbering, e.g. reservation of certain number ranges, are not expedient. It should be decided on a case-to-case basis which numbering convention is best suited to the extent and structure of the systems and plants to be identified.

FN numbering is governed by the following principles:

- Numbering starts anew when one of the preceding code elements changes.
- Numbering may be consecutive or grouping.
- Numbering need not be continuous.
- Numbering conventions, once established, may not be altered, not even in the event of changes made in the progress of planning.
- The direction of numbering coincides as a rule with that of fluid flow.
- FN numbering is governed by priorities (e.g. run pipe and branch pipe) or by a defined direction of view (e.g. from left to right, from bottom to top).

In all events it is necessary to ensure that numbering conventions, once established, may not be altered as of a specific state of progress in planning since contingent changes incur great expense.

F_N numbering subdivides the systems classified in F₃ into subsystems and system sections and plants into sections of plants.

The F_N numbering code element is of particular significance since it can be used on a project-specific basis to identify the smallest of system items and/or subfunctions. Furthermore, function-oriented numbering in F_N is very important in operations management for the recognition of functional systems engineering relationships. For this reason a mode of numbering in F_N which is oriented towards process-related tasks (subfunctions) is to be preferred from the operations management standpoint to one which is based on mechanical engineering considerations.

On this basis the process-related automation units defined for the purposes of operations management can be derived from the sub-units of the process plant. In this context the principle applies that in F_N the number 0 expresses the functional sum of the numbers 1 ... 9.

3.1.2.1 System-Based F_N Numbering

3.1.2.1.1 F_N Numbering of Subsystems, Sections of Plants and Subsystems

- **Consecutive or decadic numbering of subsystems and trains**
Subsystems and trains can be numbered consecutively or grouped decadically as appropriate to task, extent or requirements.

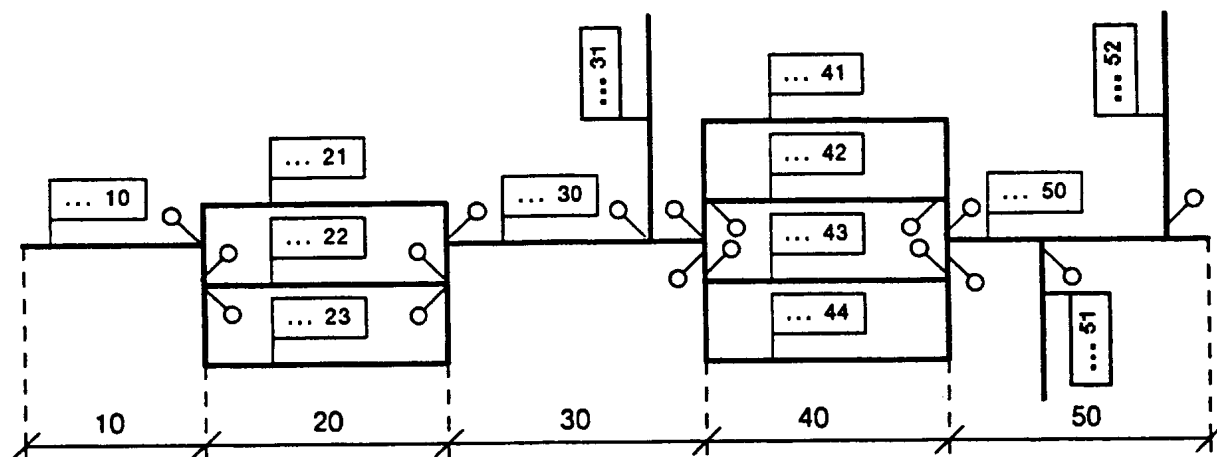
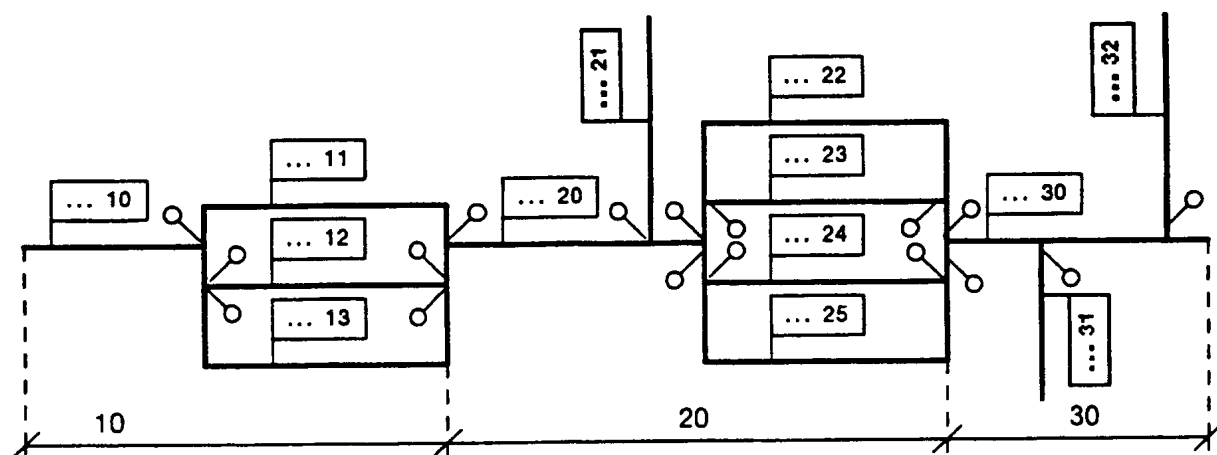
Example 12: Consecutive and decadic numbering

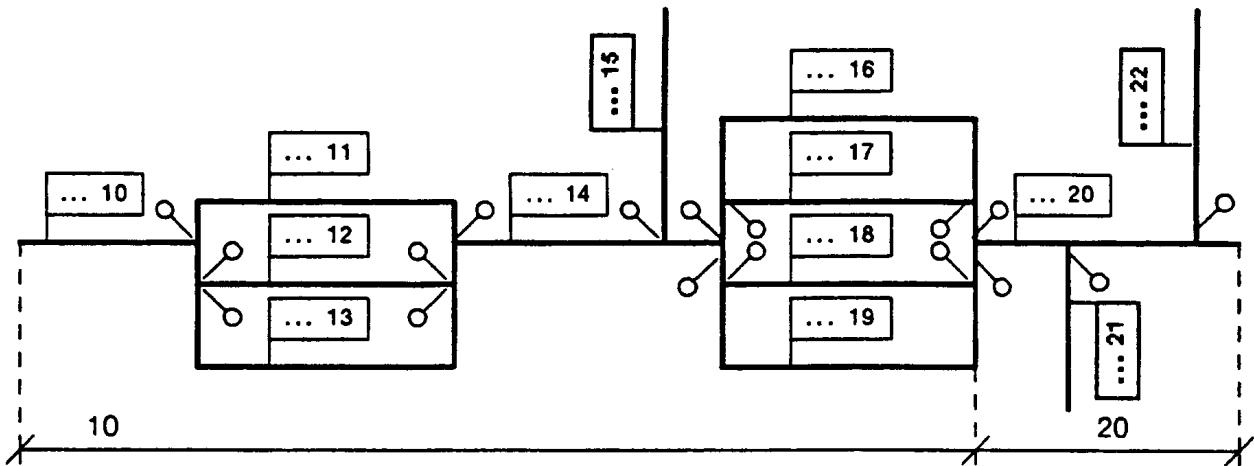
	consecutive numbering	decadic numbering
Subsystem numbering		
Train numbering		

Consecutive numbering has the disadvantage that numbers cannot be expediently inserted to identify items subsequently incorporated in the course of planning.

By contrast, decadic numbering provides reserves which however, if numbers are allocated over-generously, can also give rise to constraints in extensive systems.

Decadic subsystem numbering is suitable for extensive piping systems. The examples below show three variants with different stocks of numbers for each decade: the larger the piping system, the broader the limits of the decades.

Example 13: Decadic numbering, variant 1**Example 14:** Decadic numbering, variant 2

Example 15: Decadic numbering, variant 3

The method of subdivision into sections must, however, also consider aspects relating to functional groups and subgroups.

Thus consecutive numbering should only be used where series-connected functional groups and subgroups are present in a system. If this is not the case, subdivision by means of F_N should not be used.

Decadic numbering in subsystem numbering has advantages over consecutive numbering where sub-units (e.g. parallel trains) of piping systems form a subgroup.

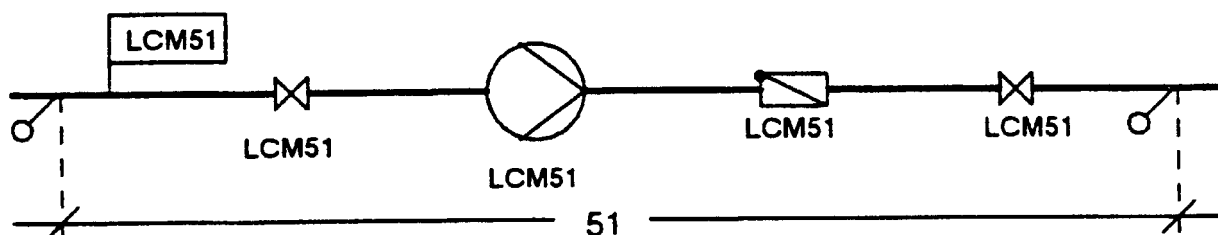
Consecutive numbering of piping trains should only be used when it is certain that this will not disassociate process-related functional groups and subgroups in F_N . It should therefore only be used after careful consideration.

Decadic train numbering should primarily be used for the identification of main piping trains in order to permit identification of auxiliary and ancillary lines in the same decade. However, here as well the subdivision of the piping system should be governed by the actually present process units such that individual functional groups and subgroups form an entity in F_N .

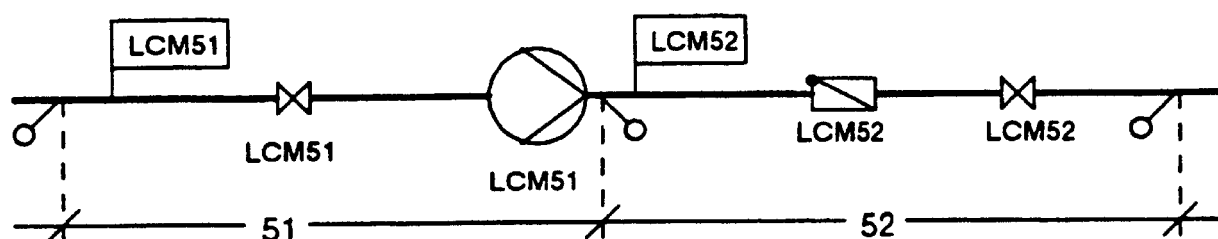
- **Numbering subdivision of subsystems and trains**

- F_N limits for mechanical equipment
Subsystems and trains can be subdivided as appropriate to which consecutive or decadic numbering convention has been stipulated and depending on the necessary identification details.

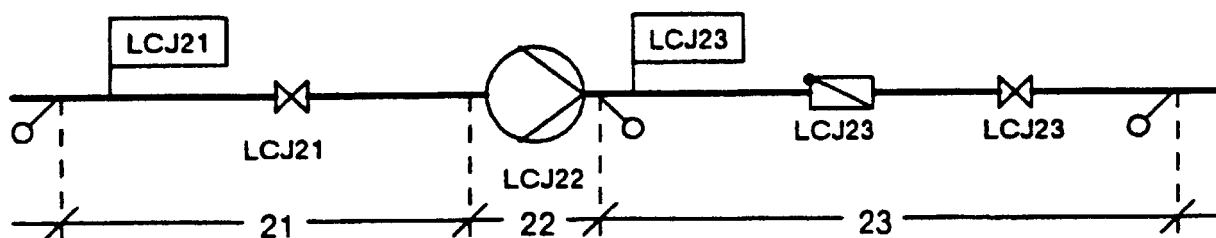
Example 16: Equipment units in piping systems, limited stock of F_N numbers



Example 17: Equipment units in piping systems, adequate stock of F_N numbers



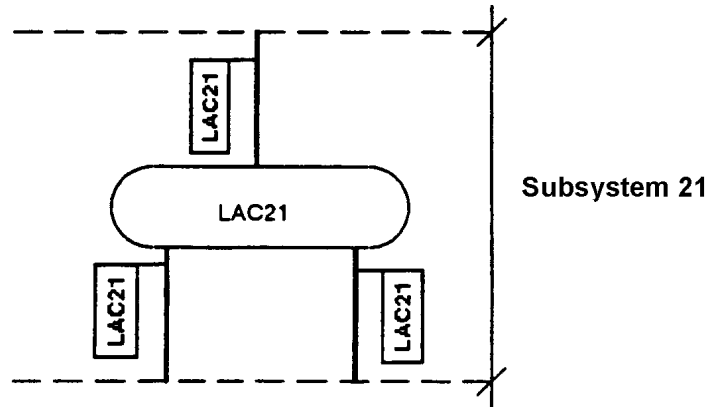
Example 18: Equipment units requiring many identification details in piping systems, adequate stock of F_N numbers



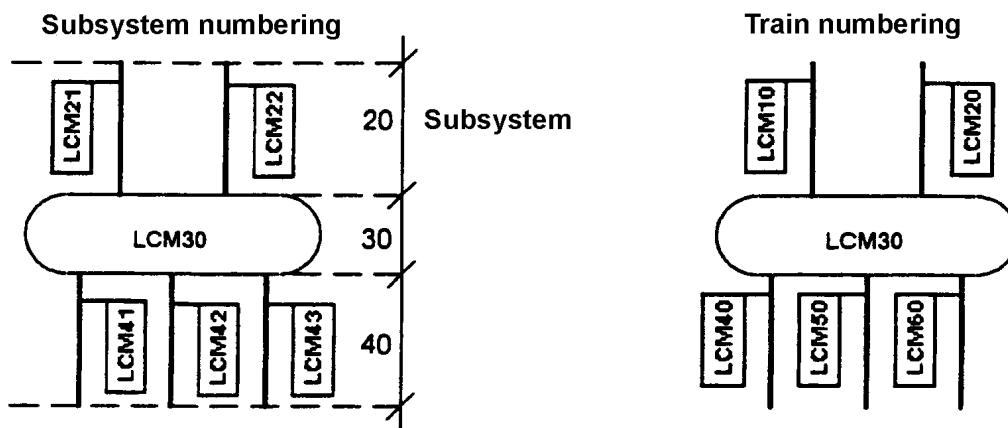
This identification variant permits functional separation of the piping train into suction and discharge lines, and also the identification of supply, disposal and auxiliary systems of the pump unit independently of the piping train.

- F_N interfaces for vessels (process vessels and tanks)

Example 19: Vessels in piping systems, limited stock of F_N numbers



Example 20: Vessels in piping systems, adequate stock of F_N numbers



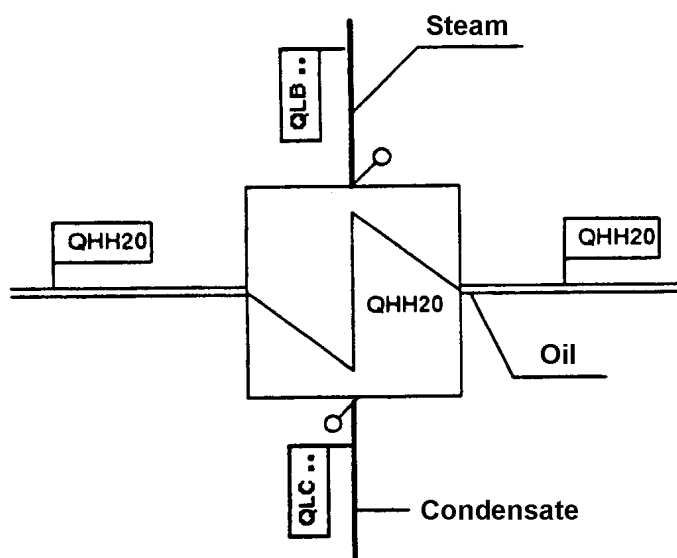
Vessels may be considered as trains in piping systems identified in F_3 . F_N numbering should be decadic in consideration of the identification details required for vessels.

- F_N interfaces for vessels (heat exchangers)
Heat exchangers are assigned in accordance with the originator principle to the system whose functions require the heat exchanger (compare section on "System Classification"):

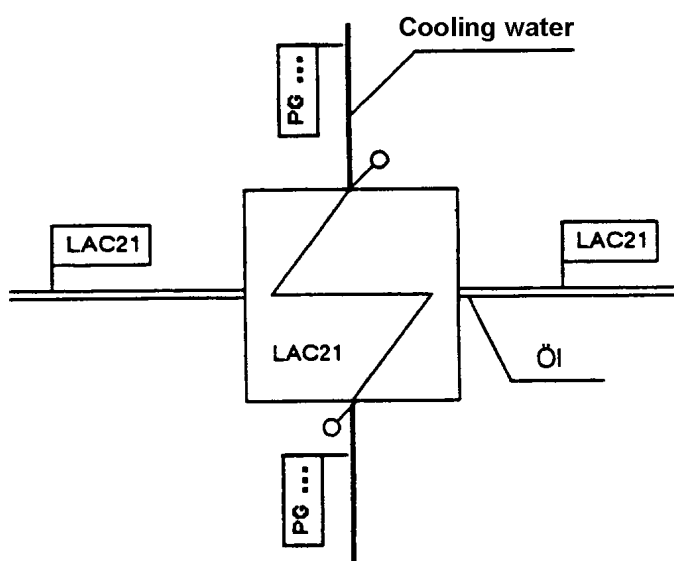
Heaters are assigned to the heat-absorbing system

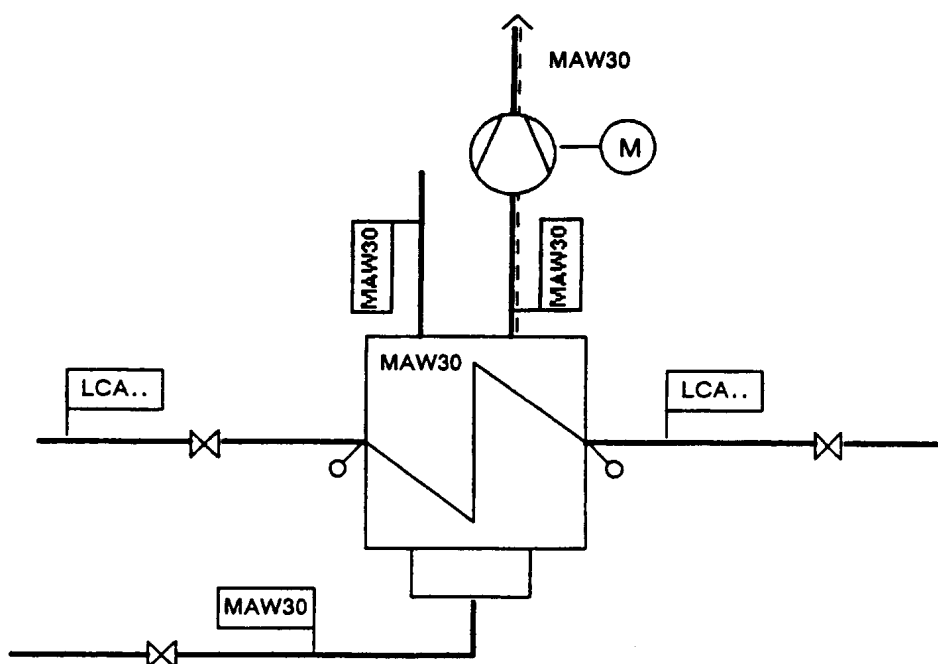
Coolers and condensers are assigned to the heat-rejecting system

Example 21: Fuel oil heater

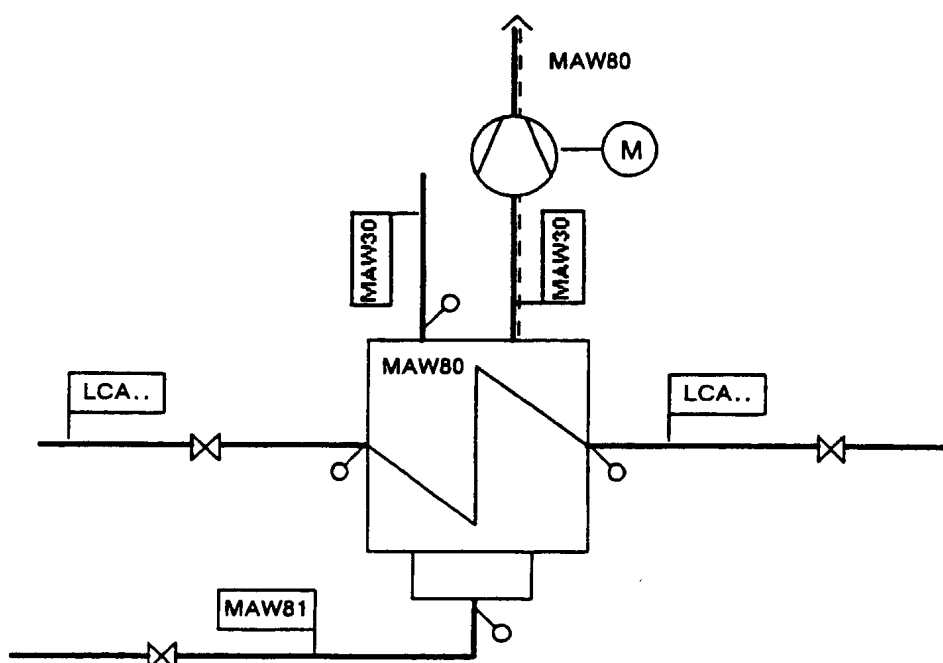


Example 22: Oil cooler for feedwater pump



Example 23: Gland steam condenser**Example 24:** Gland steam condenser

In consideration of the identification details required but depending on the stock of numbers available, the gland steam condenser may receive a separate F_N number regardless of the piping subsystem.



The examples below summarize the possible uses of:

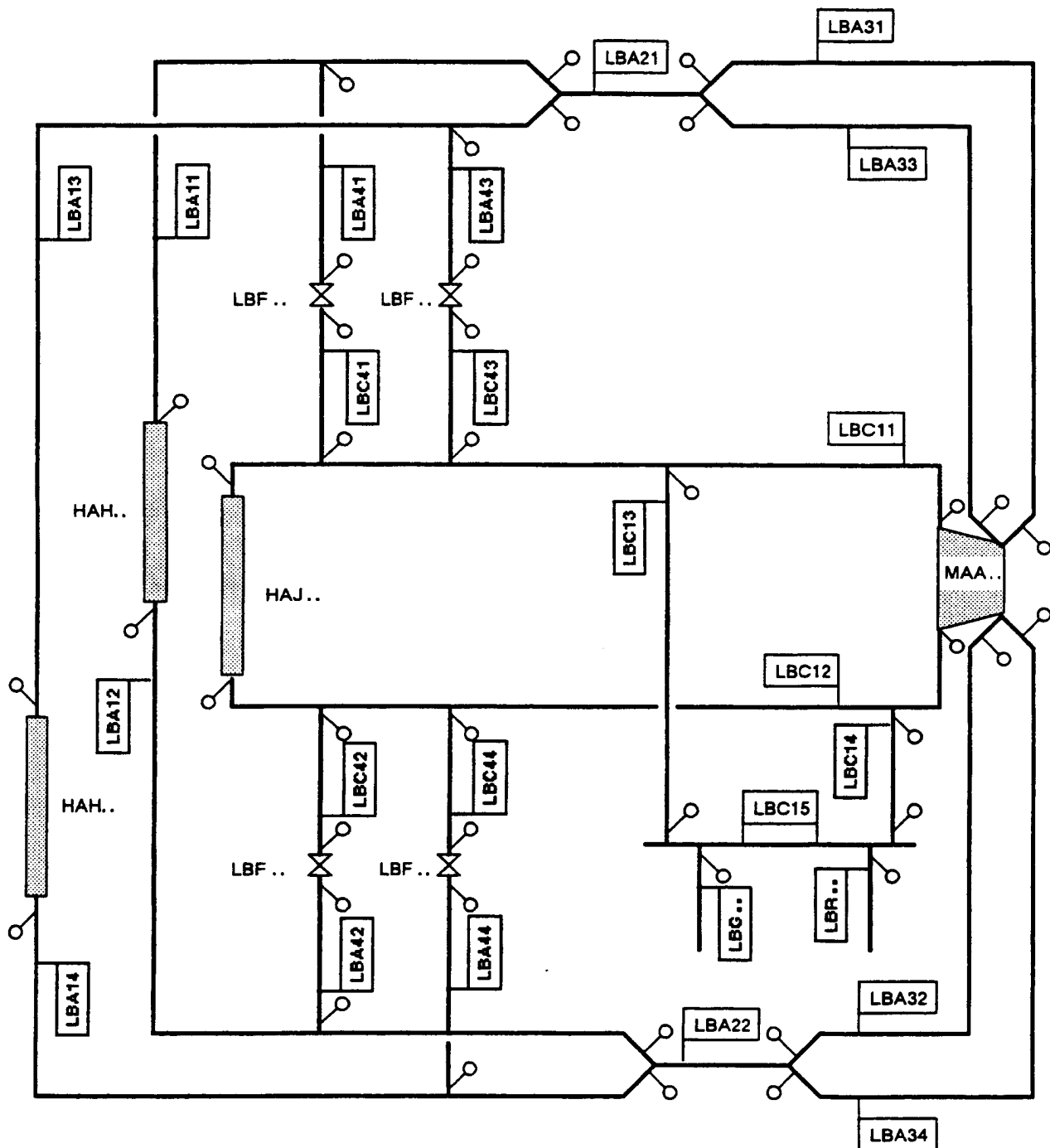
- Consecutive and decadic numbering of subsystems and trains
- Numbering subdivision of subsystems and trains
- F_N interfaces for
 - Mechanical equipment such as valves and pumps
 - Mechanical equipment such as vessels and heat

Example 25: Main steam piping system and cold reheat piping system

- Decadic grouping of subsystems and consecutive numbering of the trains of the main steam piping system LBA from the HP superheater system HAH to the HP turbine MAA:
LAB11/12, LAB13/14, LAB21/22, LAB31/32, LAB 33/34 and LBA41/42, LBA 43/44
- Decadic grouping of cold reheat piping system LBC:
LBC11/12, LBC13/14, LBC15

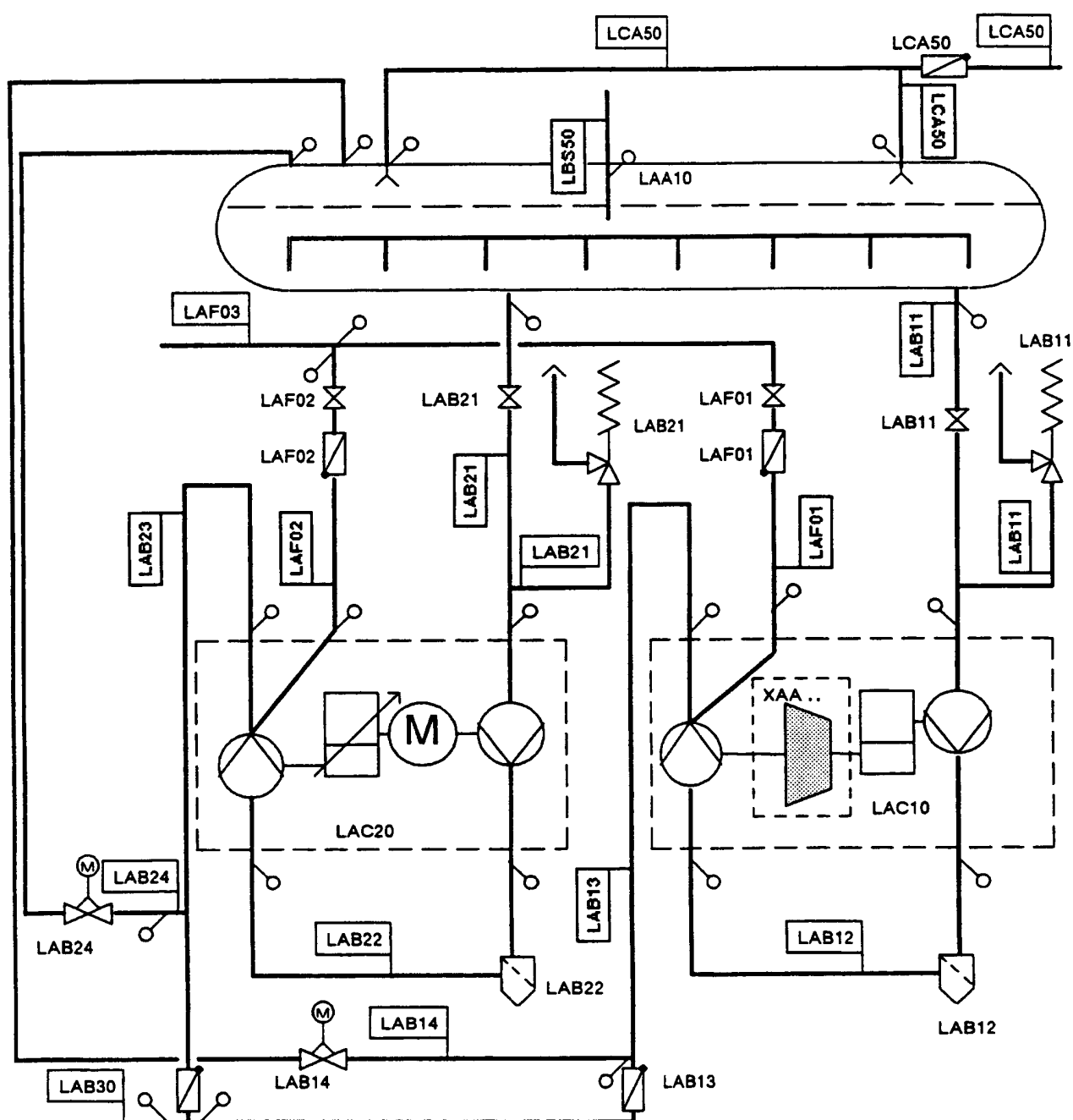
and matching to numbering of LBA

LBC41/42, LBA43/33 (cf. "Systems-Interfacing F_N Numbering")



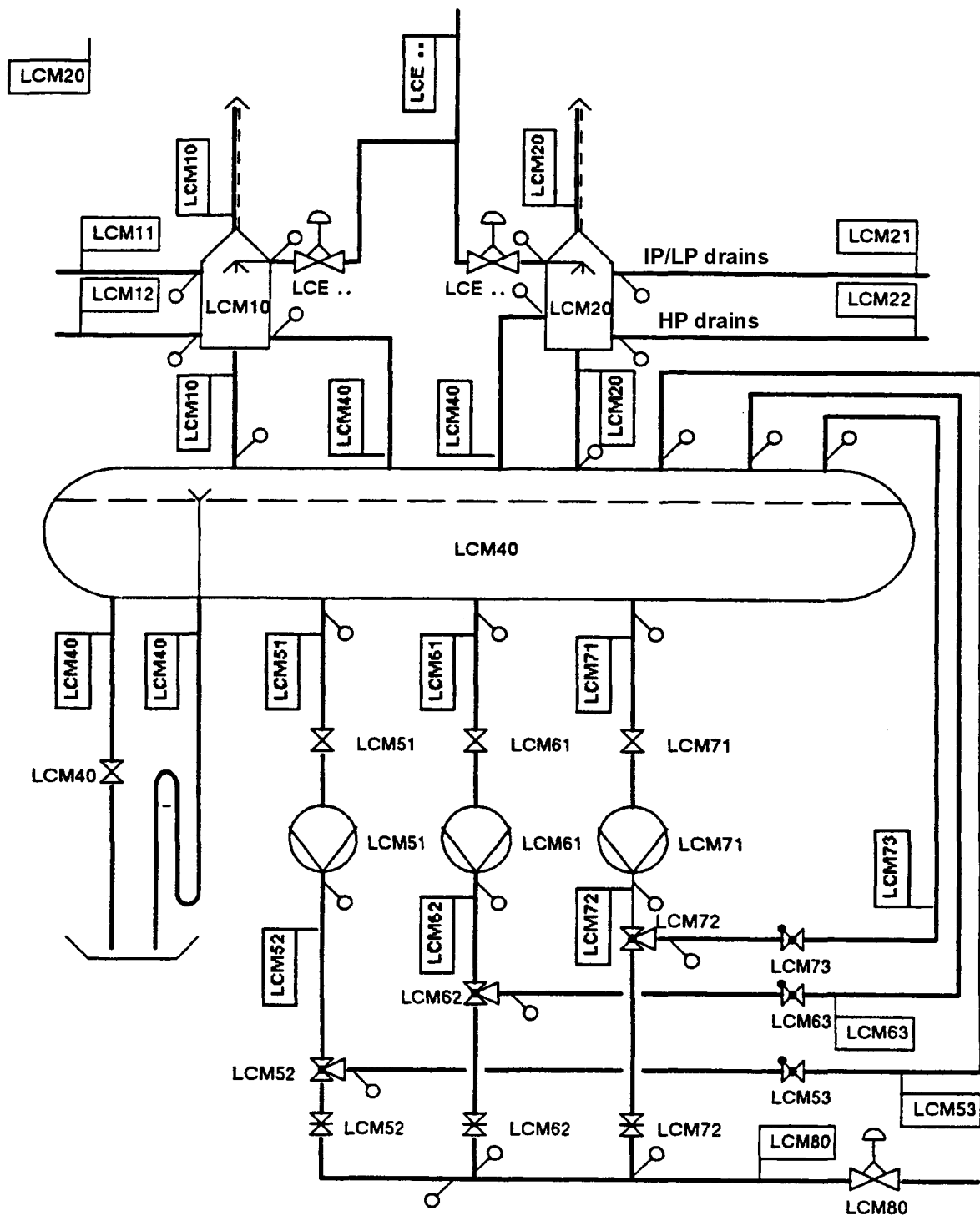
Example 26: Section of feedwater system

- Decadic grouping of feedwater piping system LAB
 - LAB1. (LAB 11,12,13,14) from feedwater pump system LAC1. to feedwater tank LAA
 - LAB2. (LAB21, 22, 23, 24) from LAC2. to LAA
 - LAB30 joint piping system
- Consistent F_N numbering of LAA, LAC and IP desuperheating spray system LAP (cf. "Systems-Interfacing F_N Numbering")
- Assignment of F_N interfaces to mechanical equipment such as valves and pumps



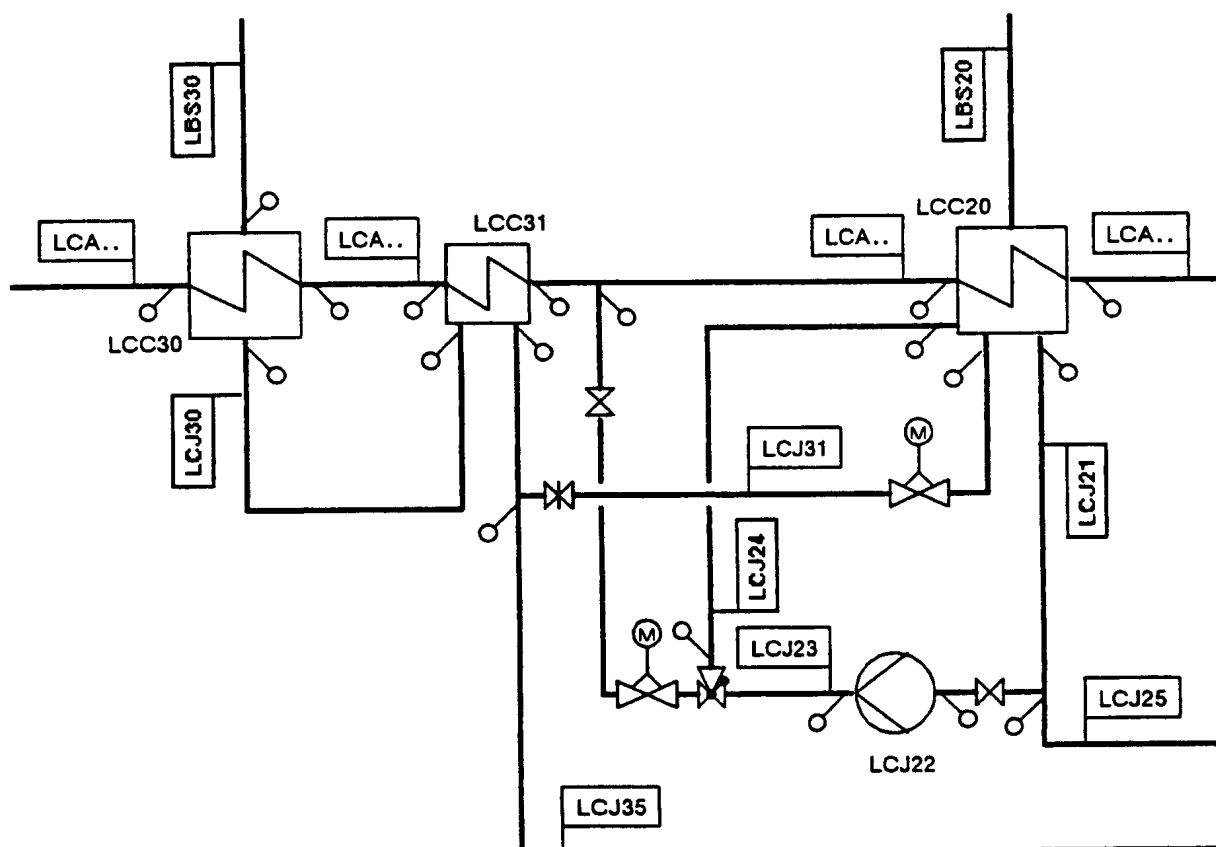
Example 27: Vessel in clean drains system

- F_N interfaces in system LCM
- Decadic grouping within system LCM (LCM10,20,30, etc.) and numbering subdivision of trains, e.g. LCM51, 52, 53
- Assignment of F_N interfaces to mechanical equipment such as valves and pumps



Example 28: Section of condensate system LC

- Decadic grouping of LP heater drains system LCJ and consecutive numbering of subsystems
- Assignment of F_N interfaces to mechanical equipment such as valves and pumps
- Assignment of heat exchangers to LP feedwater heating system LCC

**Remarks on drains cooler LCC31:**

The designation "drains cooler" is not an assignment criterion in accordance with the recommended "originator principle" of identification. The drains cooler is required for the functions of the heat-absorbing main condensate system (approximation of process to ideal Carnot cycle).

3.1.2.1.2 F_N Numbering of Plants with Associated Auxiliary Systems

F_N numbering subdivides plants and systems classified in F_3 into plant sections and subsystems respectively. This also applies to items of mechanical equipment which have dedicated system classification codes (e.g. feedwater pump system LAC).

Serial No. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F_0 F_1 F_2 F_3 F_N	A_1 A_2 A_N A_3	B_1 B_2 B_N
Type of data character	A or N	N A A A N N	A A N N N A	A A N N

L A C 2 0

- Feedwater pump system
- Feedwater pump system No. 2

F_N numbering is governed by the following principles:

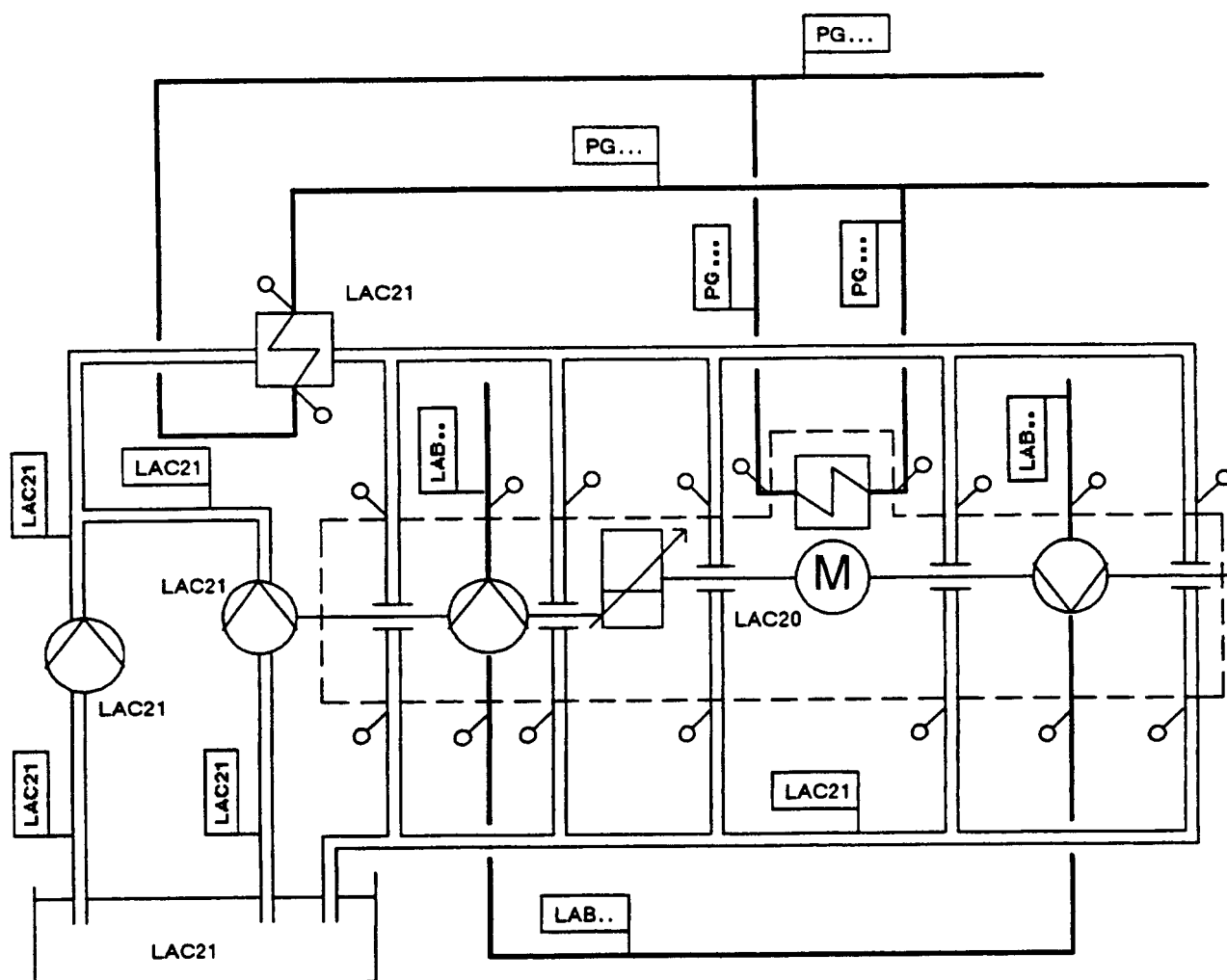
- The F_N numbering for plants and systems which require many identification details should be decadic on account of the identification details required for dedicated supply, disposal and auxiliary systems.
- The F_N numbering conventions must fit into the numbering structure of the surrounding piping systems as logically as possible.

The principle that

"the F_N numbering of plants and systems which require many identification details should be decadic on account of the identification details required for dedicated supply, disposal and auxiliary systems"

is illustrated by the identification of the lube oil system of feedwater pump system No. 2 as given in the following example.

Example 29: Feedwater pump system No. 2 with lube oil system LAC21 (section of feedwater system)



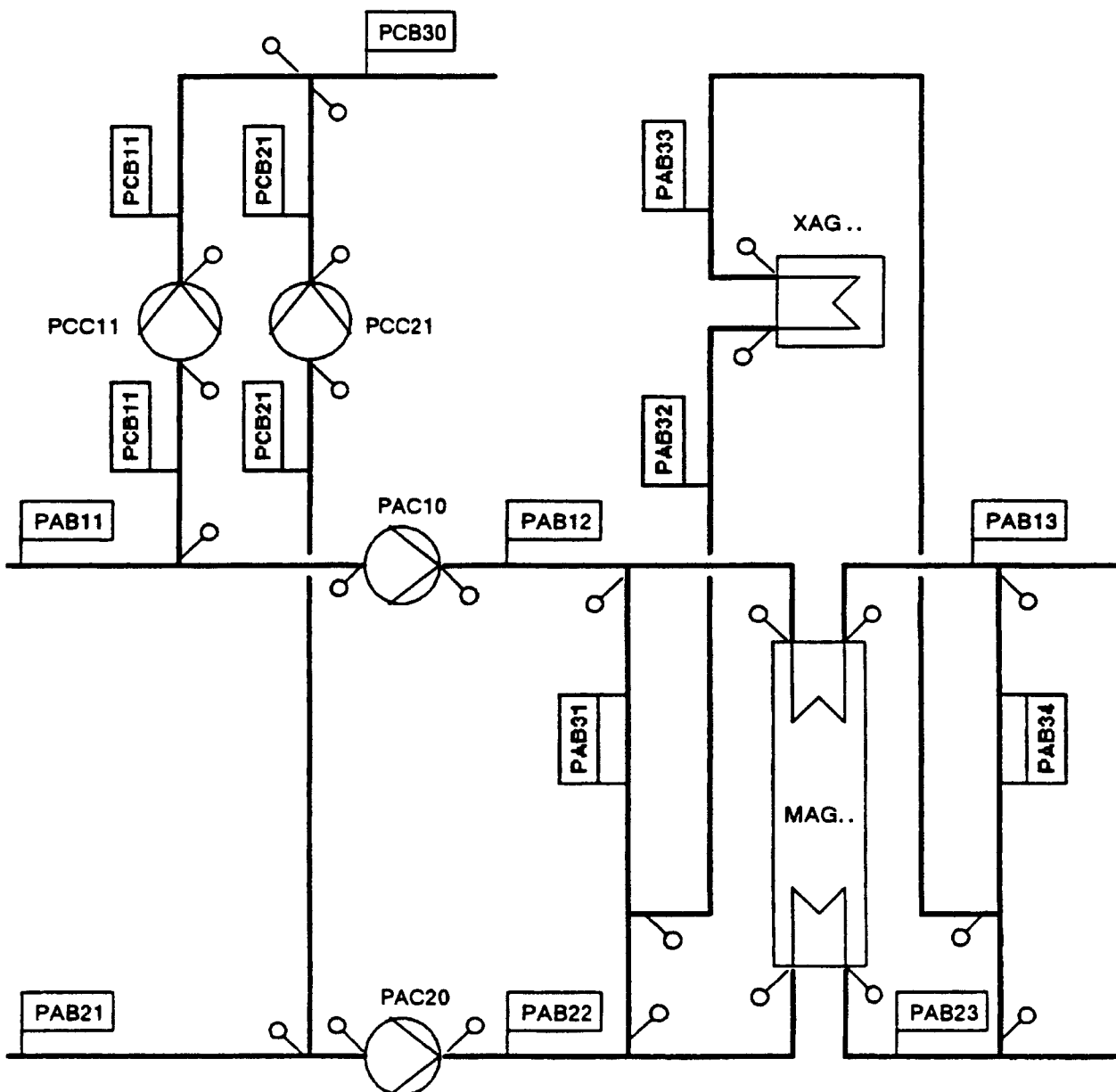
3.1.2.2 Systems-Interfacing F_N Numbering

Where interconnected trains of different systems and plants constitute a coherent coding unit, the F_N numbering of the various systems should be as similar as possible. The following principle applies:

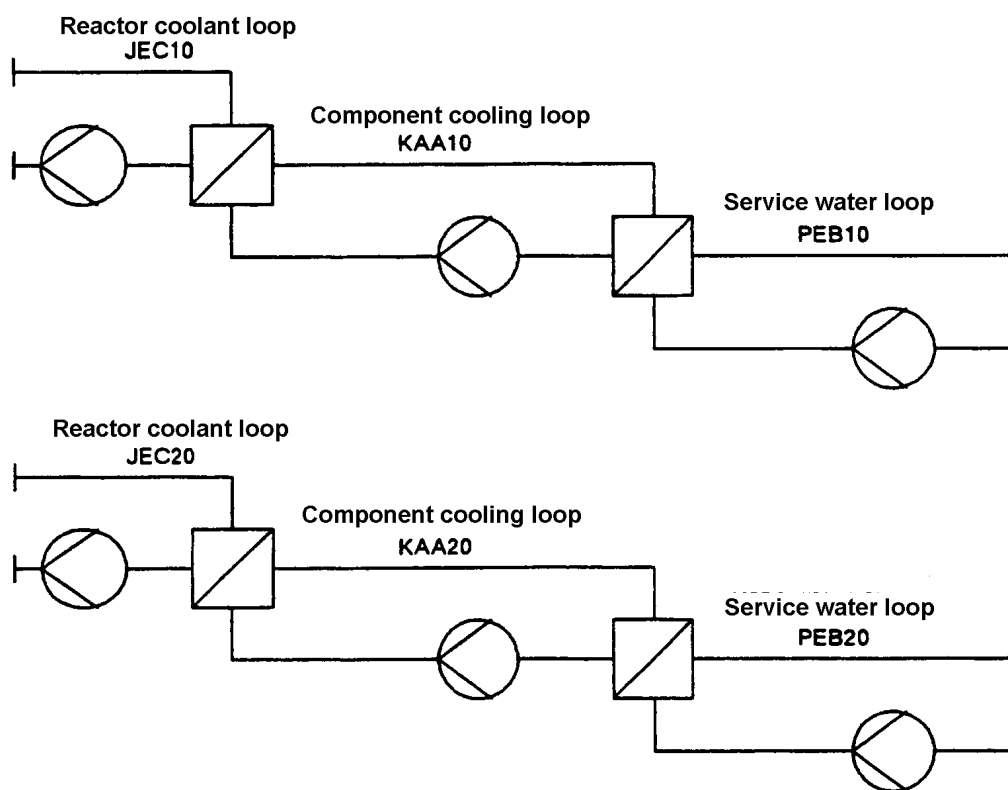
The F_N numbering convention must fit into the numbering structure of the surrounding plants and systems as logically as possible.

Example 30: Section from cooling water systems

- Identical numbering format for PAB, PCB and PCC, e.g. $F_N = 11$ is consistently used for all 3 systems



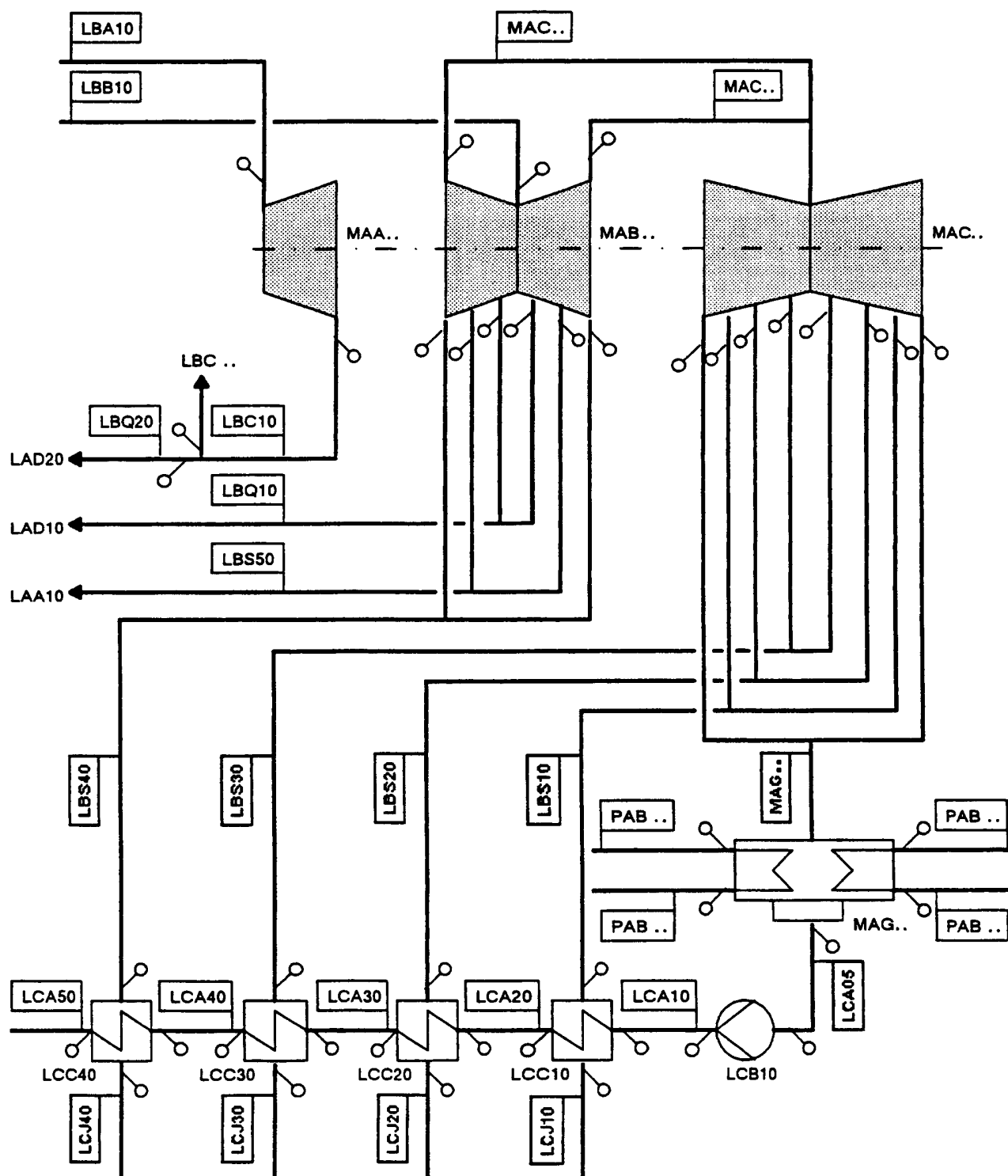
Example 31: Cooling chains comprising reactor coolant, component cooling and service water systems



▪ **F_N numbering of feedwater heating systems**

The following example, a section of the steam and condensate system, shows a possible variant on F_N numbering of feedwater heating systems in the context of piping systems.

Example 32: Section of steam and condensate system



In this example there are 2 possible ways of assigning F_N :

Variant 1: (shown in Example 32)

- IBS extractions Nos. 1 - 3 from the LP turbine MAC and LBS extractions Nos. 4 and 5 from the IP turbine MAB are grouped as LBS10 - LBS50
- LBQ extraction No. 6 from the IP turbine MAB and LBQ extraction No. 7 from the HP turbine MAA are grouped as LBQ10 and LBQ20.

Variant 2:

- All extractions, Nos. 1 - 7, are grouped in F_N from 10 to 70

The table below shows the F_N assignment of the systems.

Variant 1:

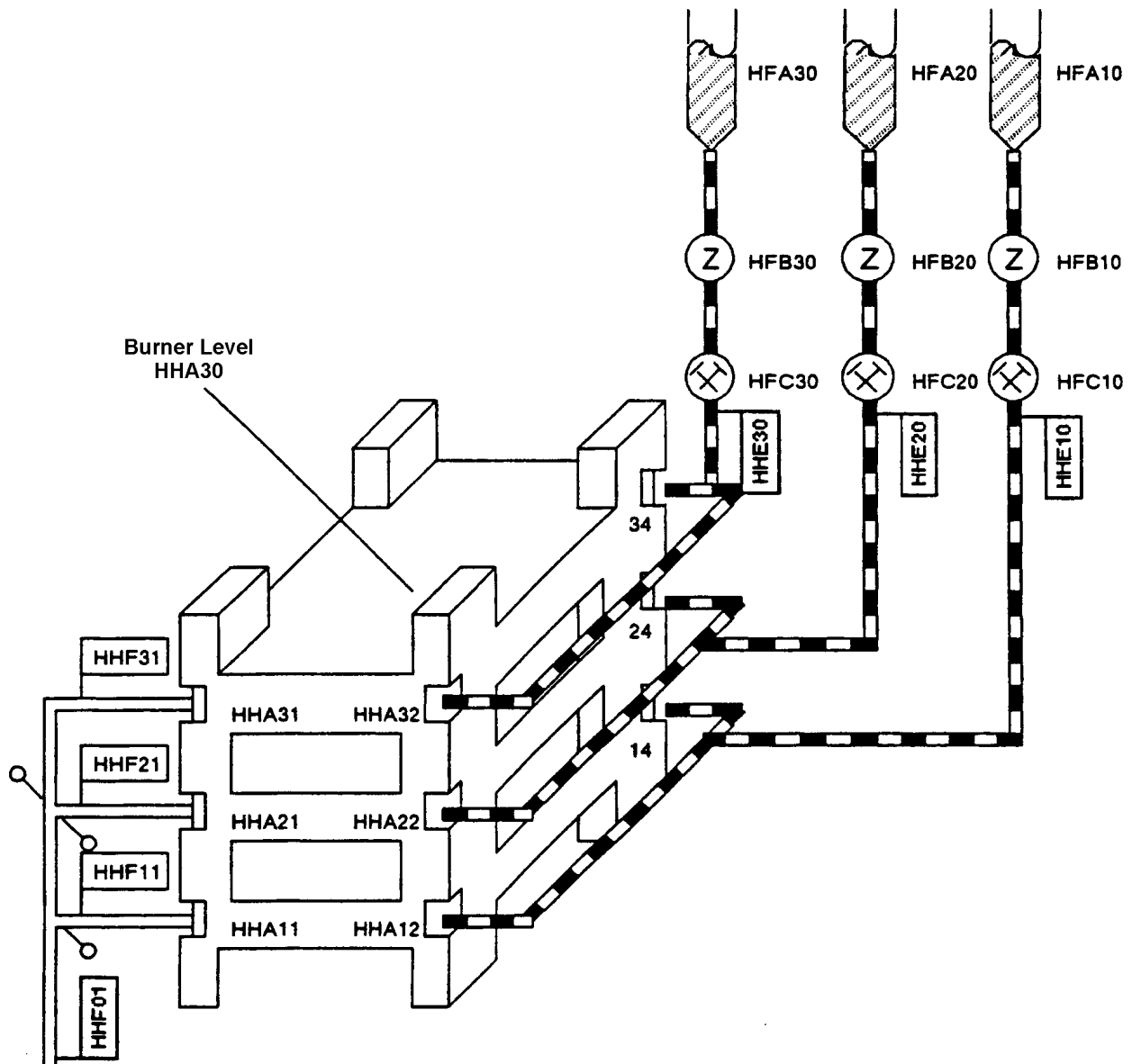
Extraction Piping System	Feedwater Heating system		Main cond. piping syst.	Heater drains syst.
Extraction No. 1 LBS10	LP heater No. 1	LCC10	LCA10	LCJ10
Extraction No. 2 LBS20	LP heater No. 2	LCC20	LCA20	LCJ20
Extraction No. 3 LBS30	LP heater No. 3	LCC30	LCA30	LCJ30
Extraction No. 4 LBS40	LP heater No. 4	LCC40	LCA40	LCJ40
Extraction No. 5 LBS50	Feedwater tank	LAA10		
Extraction No. 6 LBQ10	HP heater No. 1	LAD10		
Extraction No. 7 LBQ20	HP heater No. 2	LAD20		

Variant 2:

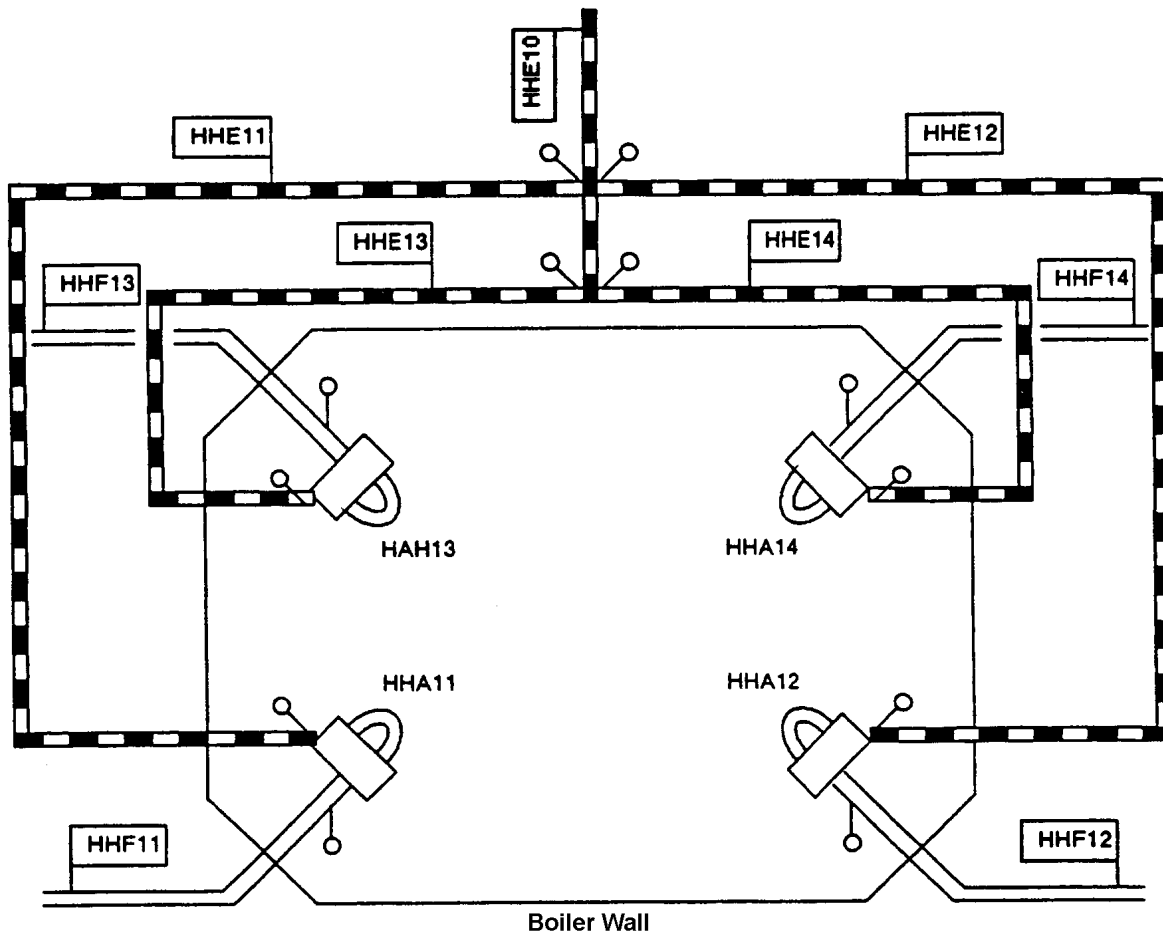
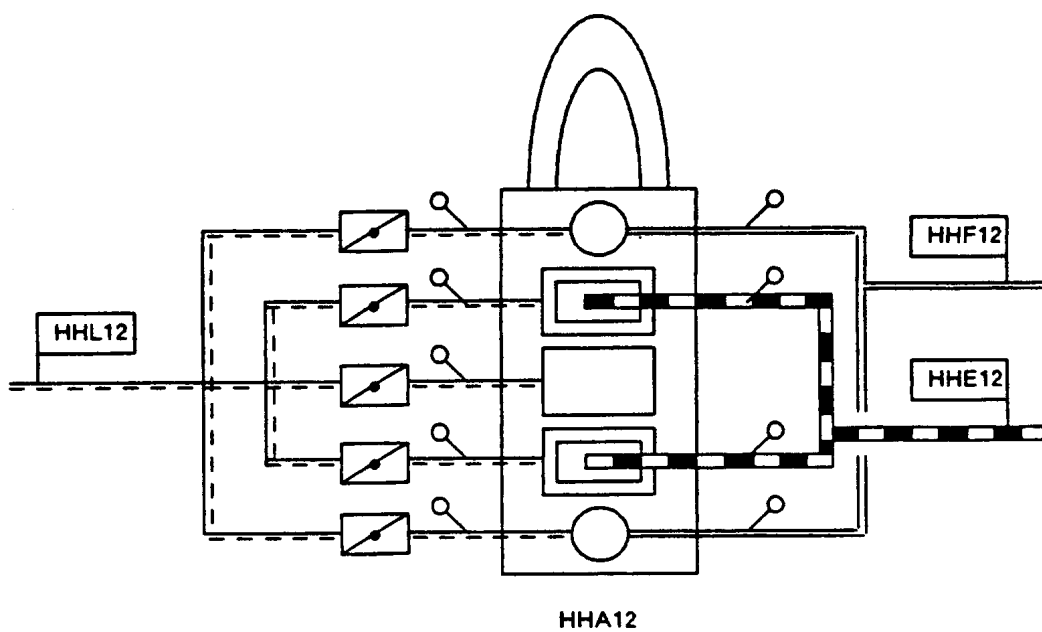
Extraction Piping System	Feedwater Heating system		Main cond. piping syst.	Heater drains syst.
Extraction No. 1 LBS10	Heater No. 1	LCC10	LCA10	LCJ10
Extraction No. 2 LBS20	Heater No. 2	LCC20	LCA20	LCJ20
Extraction No. 3 LBS30	Heater No. 3	LCC30	LCA30	LCJ30
Extraction No. 4 LBS40	Heater No. 4	LCC40	LCA40	LCJ40
Extraction No. 5 LBS50	Heater No. 5 (feedwater tank)	LAA50		
Extraction No. 6 LBQ60	Heater No. 6	LAD60		
Extraction No. 7 LBQ70	Heater No. 7	LAD70		

- F_N numbering of steam generators

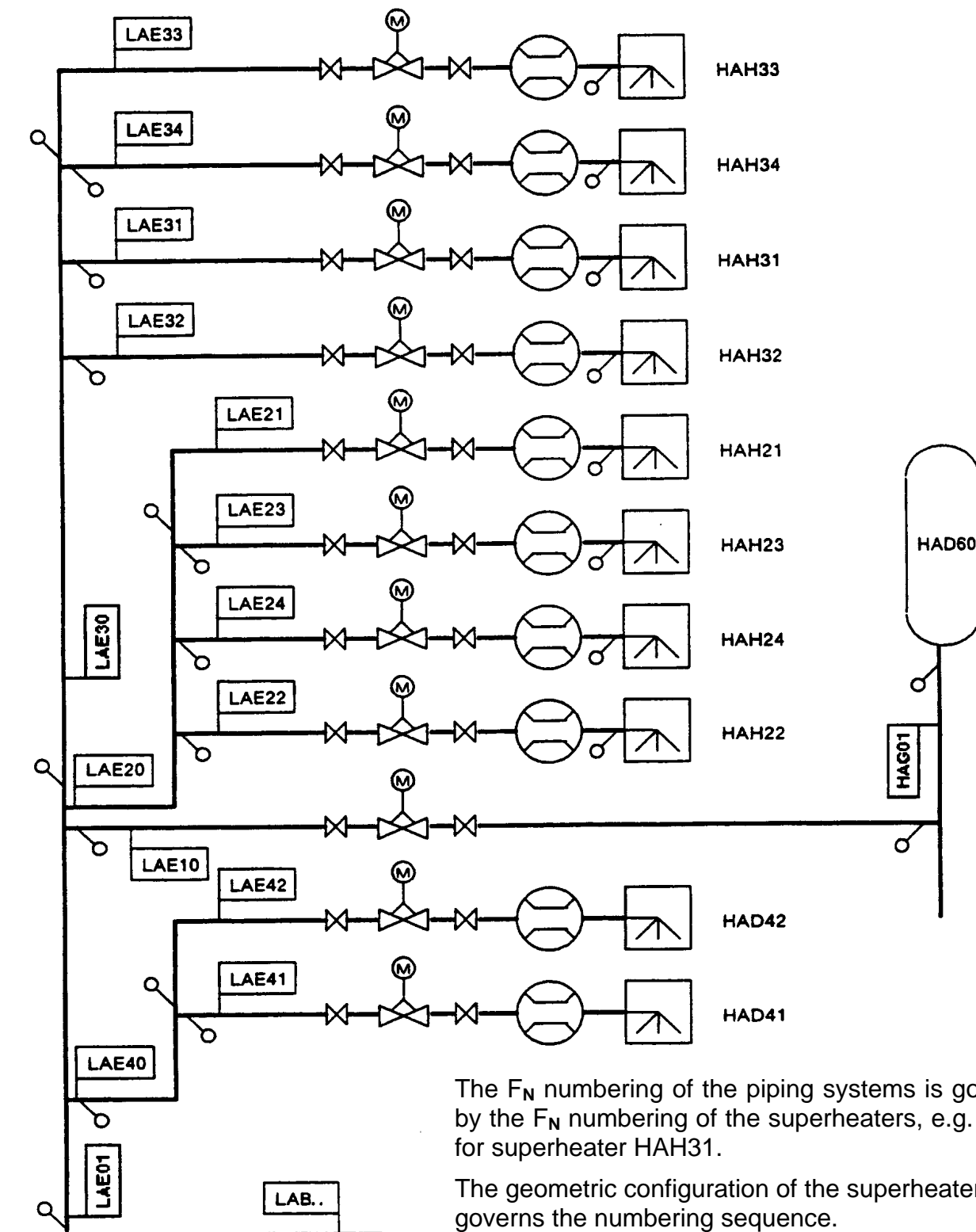
Example 33: Bunker, feeder and pulverizing systems and main burners as coherent coding units



Supply and piping systems are governed by the numbering of the main burners, e.g. HHE10 for the burners HHA1. at level 1 or HHF.1 for the burners in corner HHA.1.

Example 34: Burner level 1**Example 35: Burner 12**

Example 36: HP desuperheating spray system and pressure system of conventional heat generation system as coherent coding units



3.2 Breakdown Level 2, Equipment Unit Code

In mechanical engineering the equipment unit code subdivides subsystems and plant sections into functionally independent entities. The equipment unit code consists of equipment unit classification and numbering elements and of the additional code. Breakdown level 2 may only be used in conjunction with breakdown level 1.

3.2.1 Equipment Unit Code

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

Equipment unit classification

Classification of mechanical equipment, electrical and control and instrumentation equipment as per KKS Key

Coding letters and designations of the main groups A₁, as given in the Equipment Unit Key:

- A** Mechanical equipment
- B** Mechanical equipment
- C** Direct measuring circuit
- D** Closed-loop control circuit
- H** Subassembly of main and heavy machinery
- J** Nuclear assembly

The subdivisions in A₂ are given in the applicable Equipment Unit Key.

The equipment classification of main group **A** = mechanical equipment, e.g.

- AA** Valves
- AC** Heat exchangers
- AN** Compressor, fan units
- AP** Pump units
- AT** Cleaning, drying, filtering, separation equipment

codes the equipment units thus designated which are made up of components such as a drive, a coupling and a pump.

Exception: e.g. large internal-combustion engines, turbines and generators for example are identified in F₁ as heavy machinery.

Valves are to be identified with **AA** irrespective of their type, size, type of actuator and importance in the system. This entails that, from the identification standpoint, the smallest drain valve is to be treated in the same way as an HP valve in the feedwater system for example.

The codes for pump, compressor and fan units also include priming stages (such as booster pumps).

From the identification standpoint, the equipment unit classification of main group **B** = mechanical equipment, e.g.

- BB** Vessels
- BR** Piping
- BN** Jet pumps, injectors
- BQ** Supports

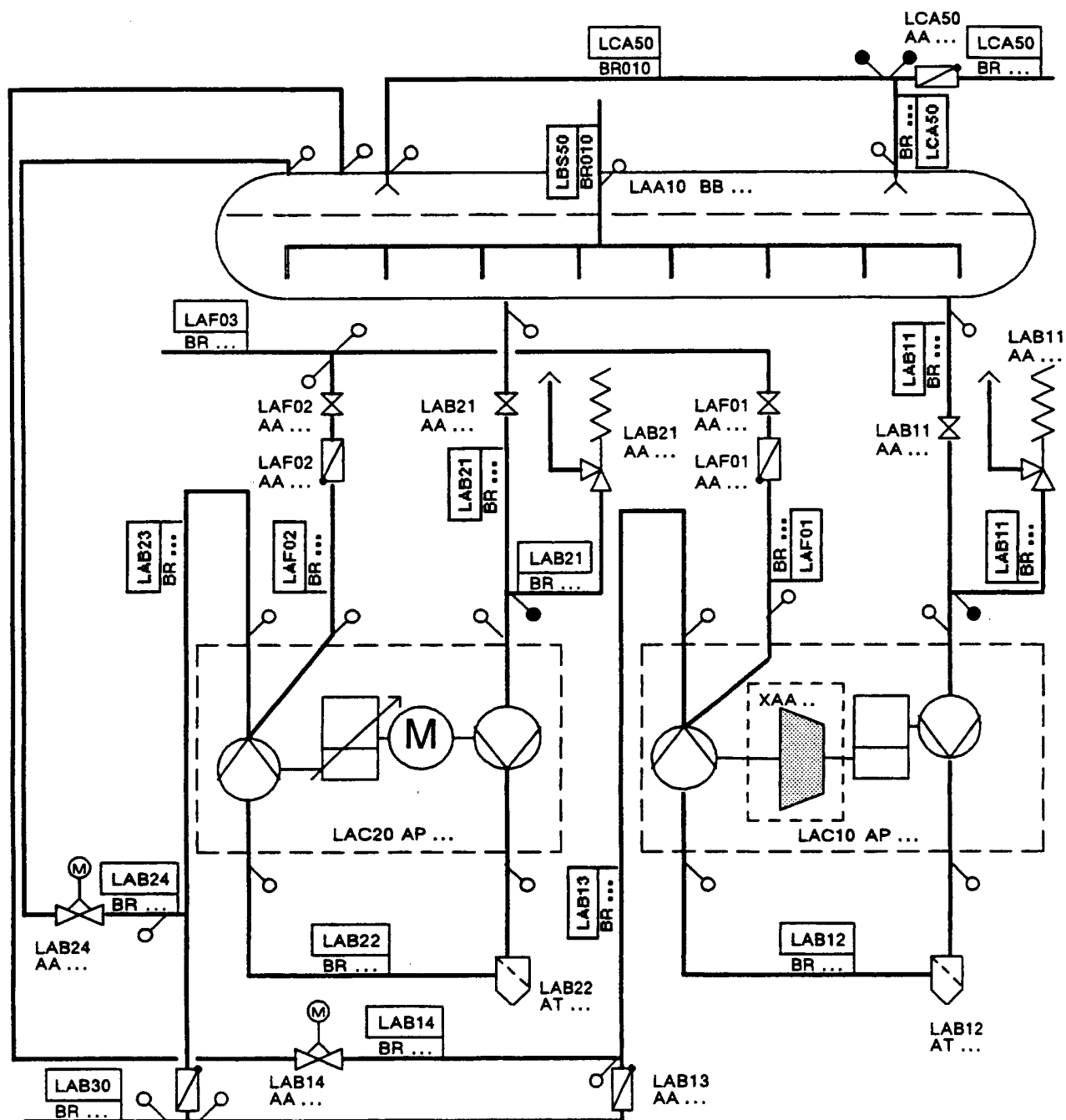
does not strictly speaking code equipment units but components.

However, since breakdown level 3 for "components" cannot be directly combined with breakdown level 1 for "systems", such items are identified on breakdown level 2. The same applies to the subassemblies of main and heavy machinery (A₁ = H) and nuclear assemblies (A₁ = J).

Note: This enables accordingly smaller items to be identified on breakdown level 3, e.g.

- Piping products **MR** for piping **BR**
- Transmission gear **MU** for supports **BQ**

Example 37: Mechanical equipment classification
(Example 26 with additions)



Mechanical equipment added:

AA	Valves	BB	Vessels
AP	Pump units	BR	Piping
AT	Filtering equipment		

3.2.2 Equipment Unit Numbering

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

Equipment unit numbering

Numbering of mechanical equipment, electrical and control and instrumentation equipment

Redundant zeros must be written.

The A_N number of breakdown level 2 is used to number the items of equipment classified in A₁ and A₂. Generally valid rules on the use of the A_N number such as on the reservation of certain number ranges for specific applications are neither expedient nor possible.

A_N numbering is governed by the following principles:

- A_N numbering starts anew when one of the preceding code elements changes.
- A_N numbering may be consecutive or grouping.
- The direction of numbering coincides as a rule with that of fluid flow.

In all events it is necessary to ensure that numbering conventions, once established, may not be altered as of a specific state of progress in planning since contingent changes incur great expense.

Details of application are subject to agreement between the parties to the project.

3.2.2.1 A_N Numbering of Mechanical Equipment and Direct Measuring Circuits

The A_N numbers of breakdown level 2 identify independently of one another mechanical equipment and direct measuring circuits which are installed in the subsystems and plant sections and classified in A₂.

Correlation of mechanical equipment and direct measuring circuits with their points of installation e.g. in piping subsystems A₁ A₂ = **BR** is not possible in the KKS since

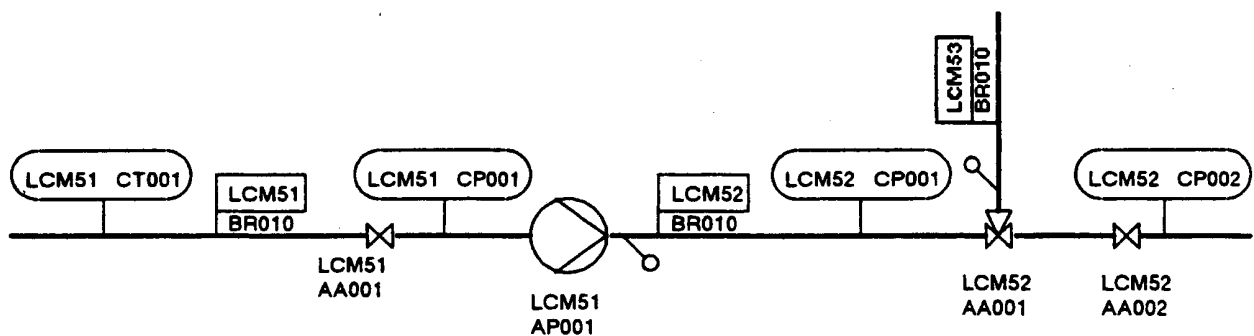
- piping subsystems

and

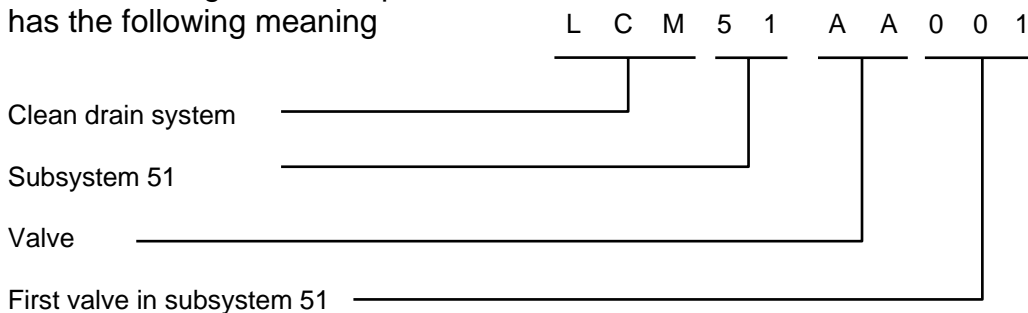
- mechanical equipment and direct measuring circuits installed in piping

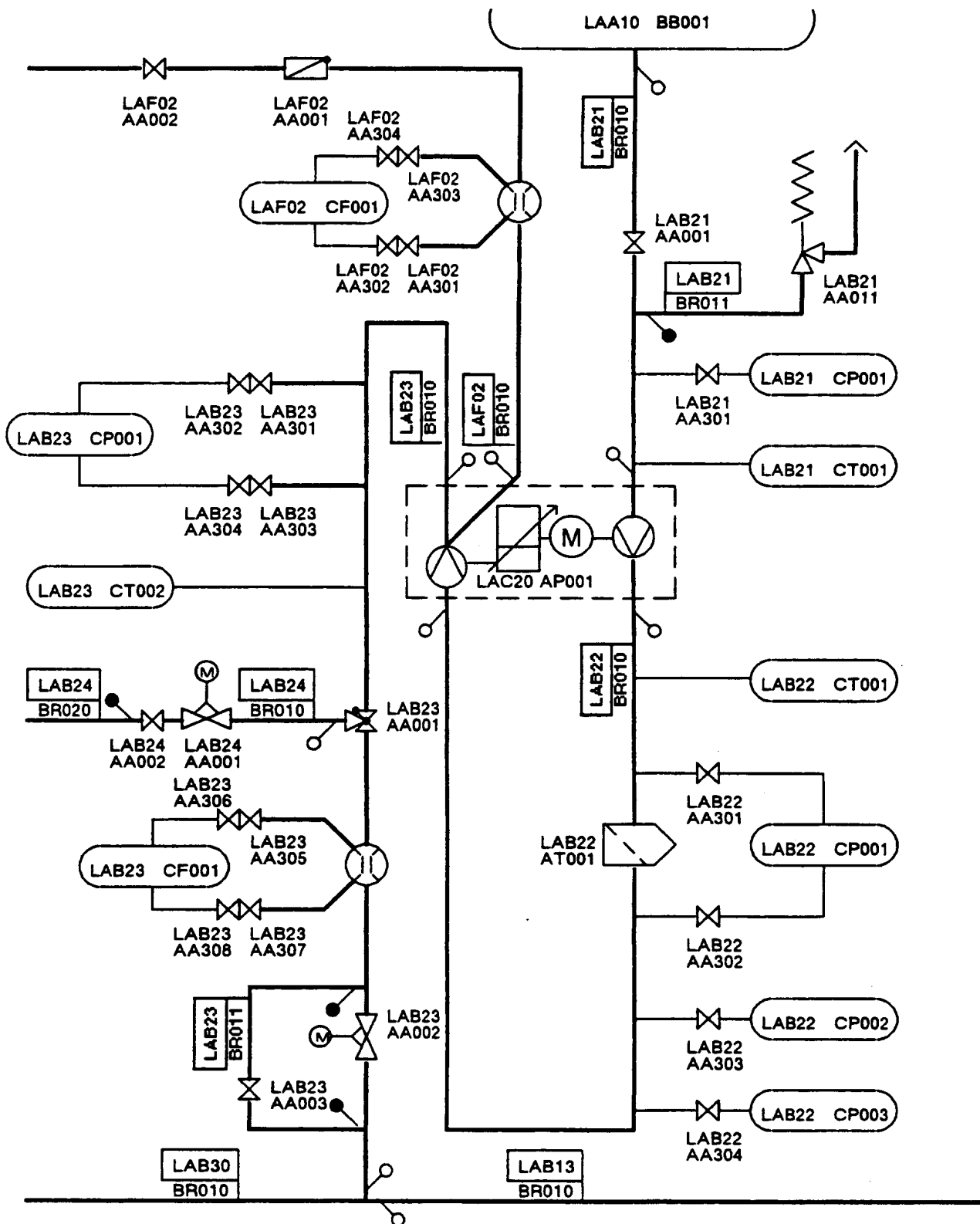
are identified on the same hierarchical level of the code. The same applies to pressure gauges on pumps for example.

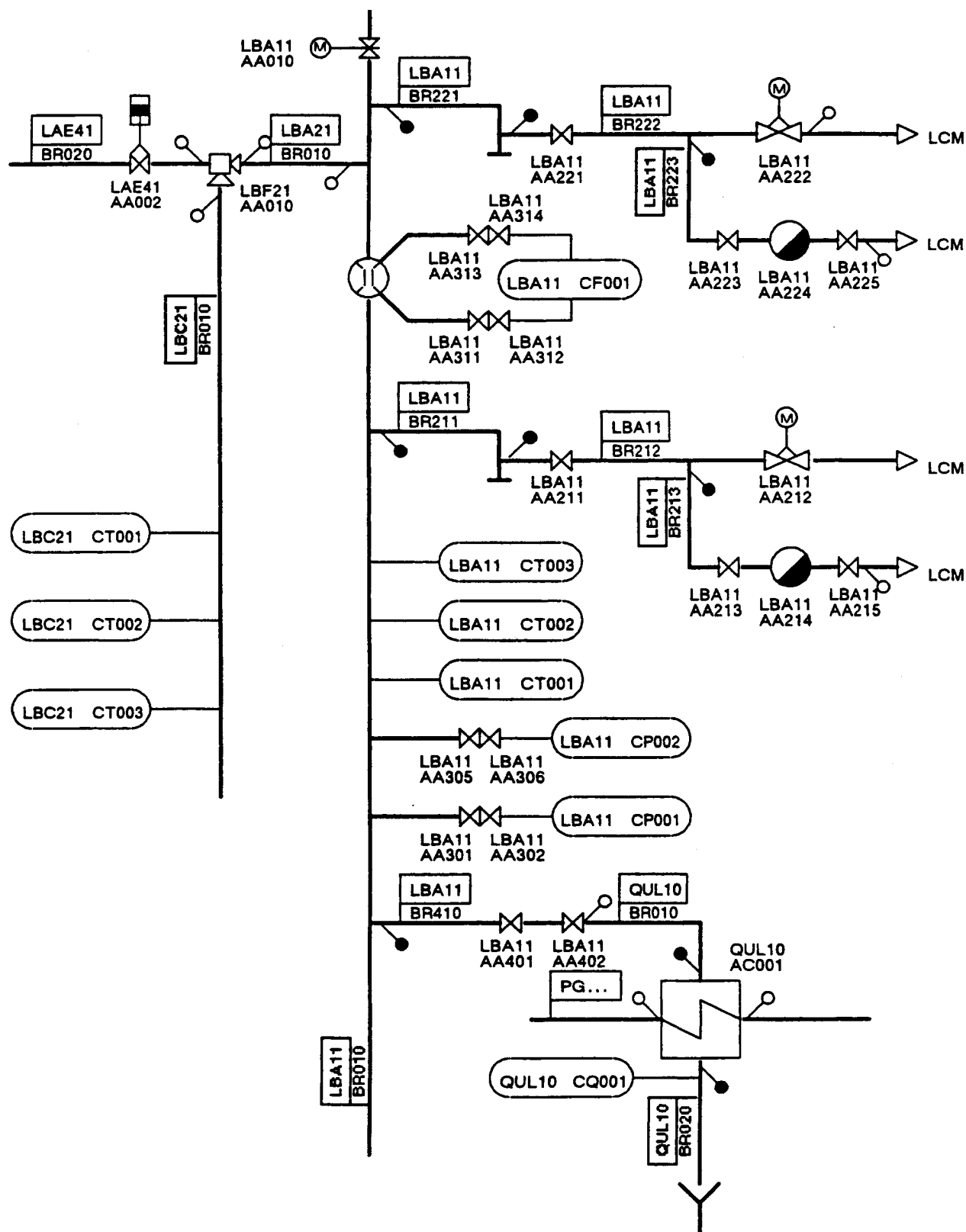
Example 38: Mechanical equipment and direct measuring circuits in subsystems of the clean drains system LCM

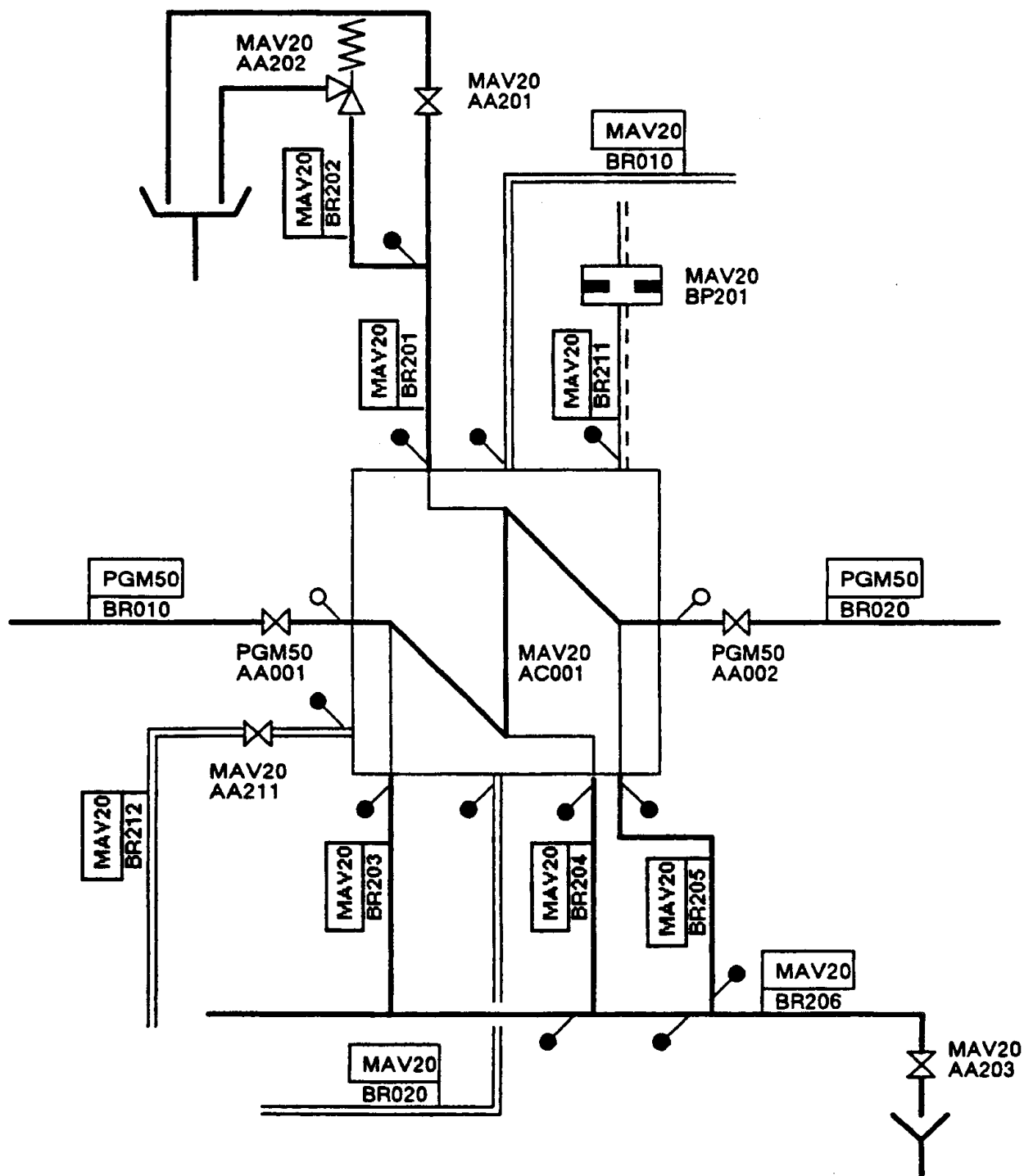


The code at right for example has the following meaning



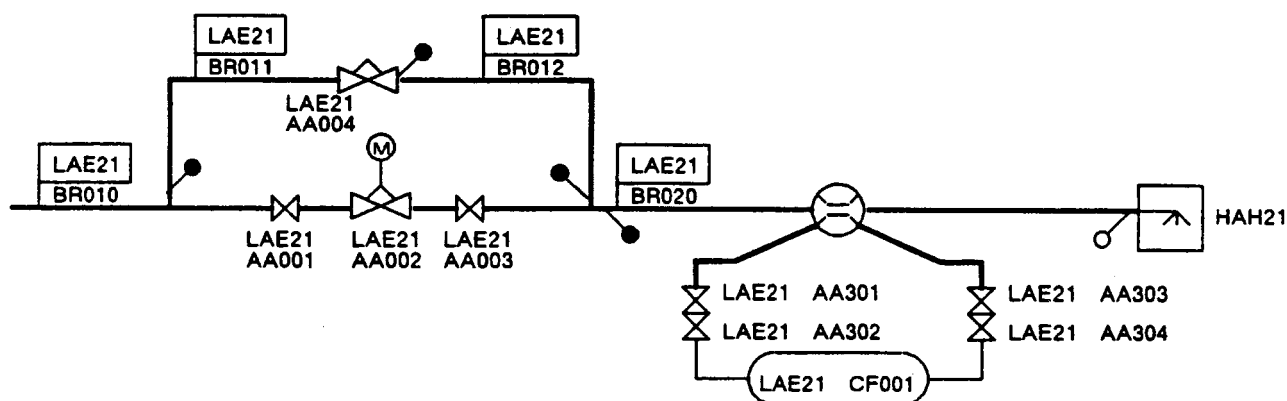
Example 39: Equipment units and measuring circuits in feedwater system

Example 40: Equipment units and measuring circuits in main steam piping system

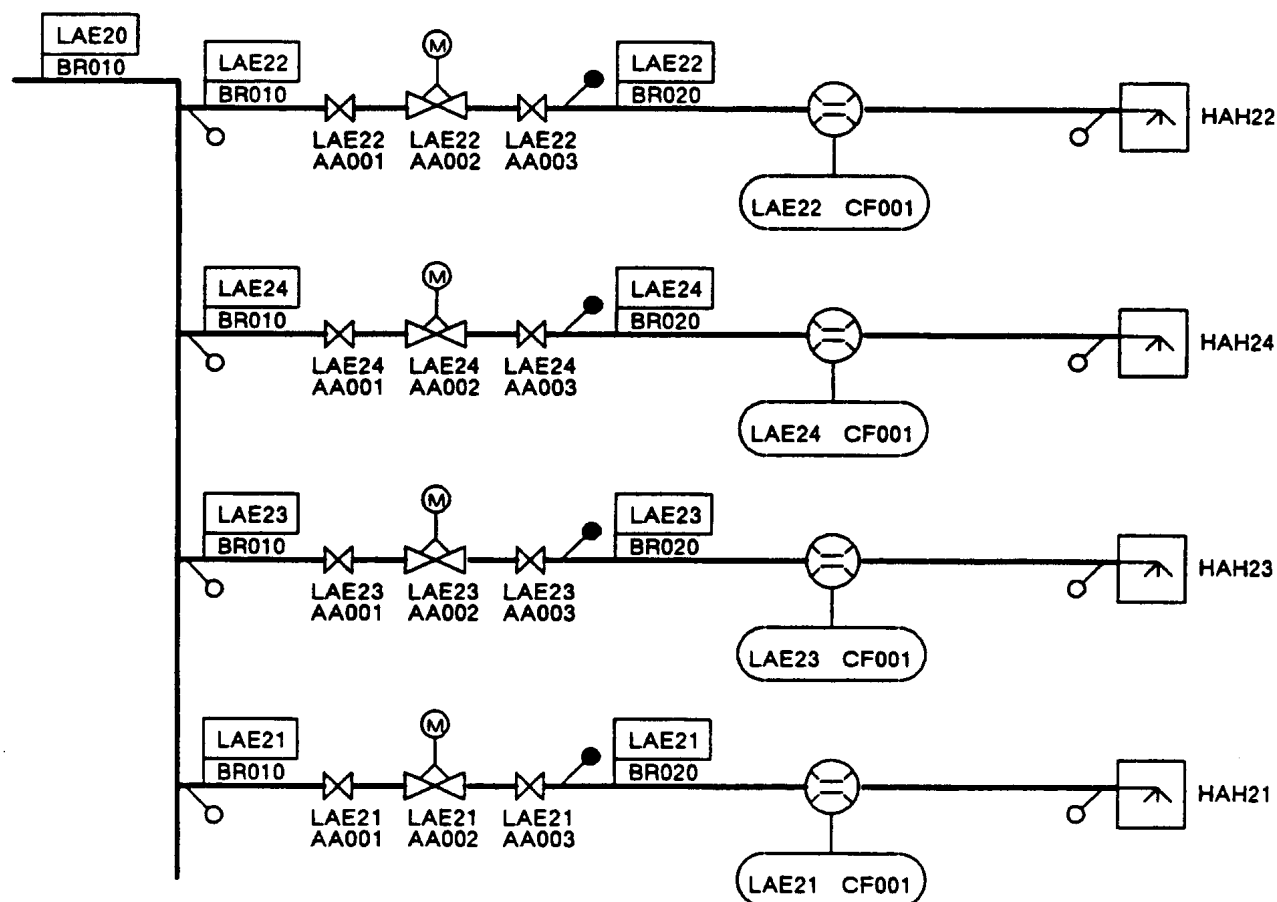
Example 41: Bearing oil cooler in lubricant supply system MAV

Example 42: Valve and direct measuring circuits in HP desuperheating spray system

1. Single subsystem



2. Parallel subsystems 21 to 24 (incomplete representation)



Remarks on:

Example 39

Agreed and applied 100s grouping:

- 3.. for isolation valves in instrument lines

Examples 40 and 41

Agreed and applied 100s grouping:

- 2.. for pipes and valves in drains and vents
- 3.. for isolation valves in instrument lines
- 4.. for pipes and valves in sampling lines

Example 42 "Valves and direct measuring circuits in HP desuperheating spray system"

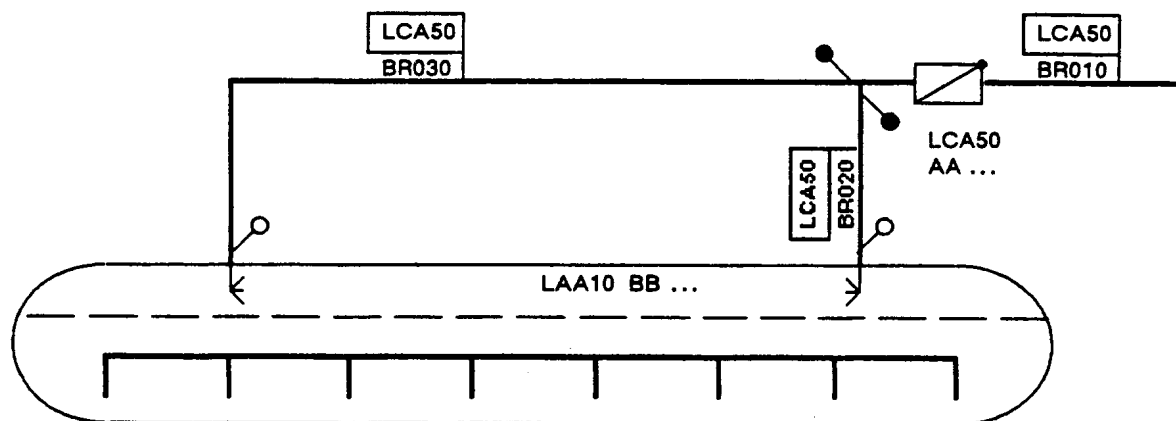
The parallel trains of the piping systems are subdivided into subsystems in the F_N number of breakdown level 1. Identically arranged valves and measuring circuits installed in the piping of the parallel subsystems receive the same A_N number on breakdown level 2.

This identification convention, which presupposes train-wise or decadic subsystem numbering of the piping system is always preferable in that the system concerned can be better structured. This has considerable advantages in planning, documentation, operations management, fault tracing and maintenance.

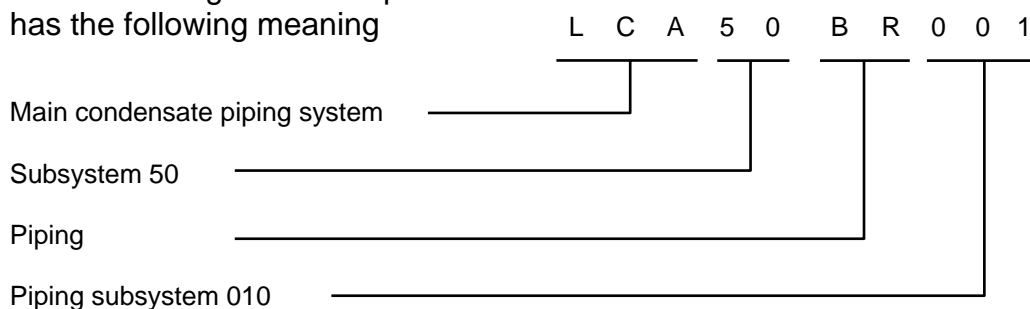
3.2.2.2 Numbering of Piping

A_N numbering identifies piping subsystems in subsystems.

Example 43: Piping in a subsystem of the main condensate piping system



The code at right for example has the following meaning



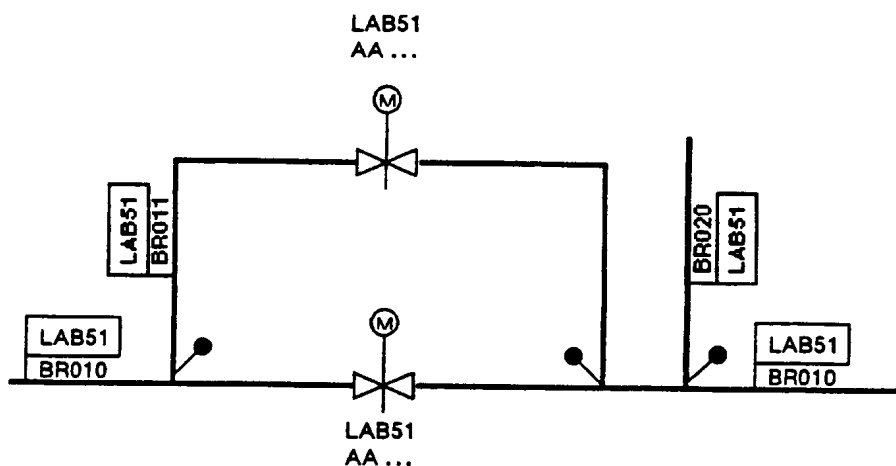
A decadic mode of numbering is preferable for piping subsystems handling main fluid. This presents the possibility of correlating branches and bypasses with decadically identified piping subsystems using the units data character and of harmoniously fitting additional piping subsystems into an existing identification structure without disturbing other codes, even at an advanced stage of planning after identification conventions have been established.

The terminals of piping subsystems within subsystems are governed by changes in process and design data and also by responsibility for supply. In flow diagrams terminals are made apparent by (for example):

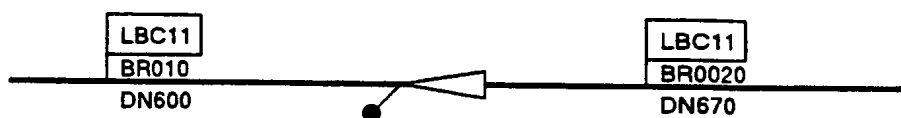
- Pressure level
- Temperature level
- Pipe branches
- Change in diameter (nominal diameter)
- Reducing valves
- Large items of equipment (such as pumps, heat exchangers)
- Change in requirement category (safety class)
- Terminal points of supply
- Terminals of structures

Example 44: Terminals of piping subsystems defined by

- Pipe branch/bypass in subsystem 51 of feedwater piping system LAB

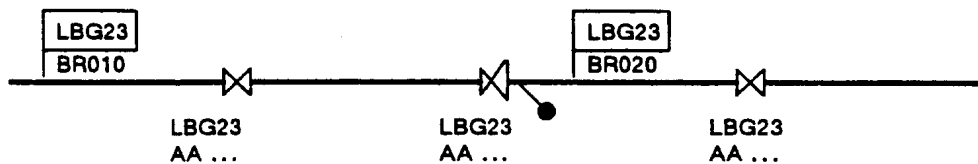


- Change in diameter formed by reducer in subsystem 11 of cold reheat system LBC

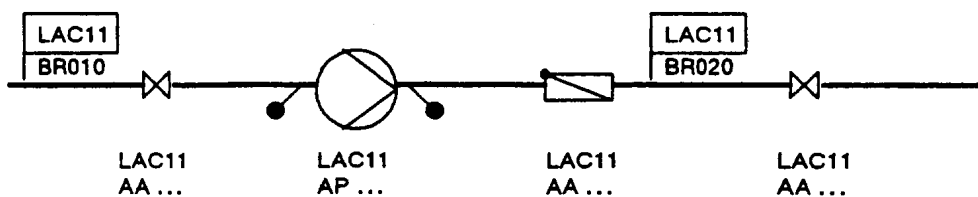


Reducers are assigned to the piping subsystem with the larger diameter. They need not be shown on flow diagrams.

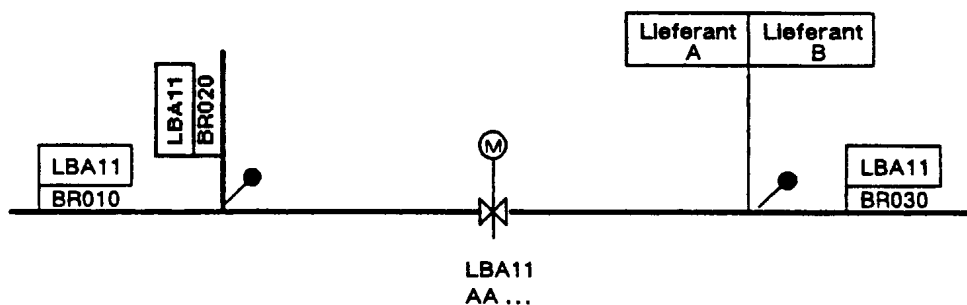
- Reducing valve in subsystem 23 of auxiliary steam piping system LBG



- Pressure difference due to oil pump in lube oil system LAC11 of feedwater pump system LAC10



- Terminal point of supply in subsystem 11 of main steam piping system LBA



3.2.2.3 Additional Code (Pilot Valves)

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N (A)	A A N N

Additional code for the equipment unit code

Consecutive lettering is used in A₃ for 'numbering' purposes where for some reason an entity identified up to and including A_N is to be further subdivided on breakdown level 2.

The additional code is used in the following cases:

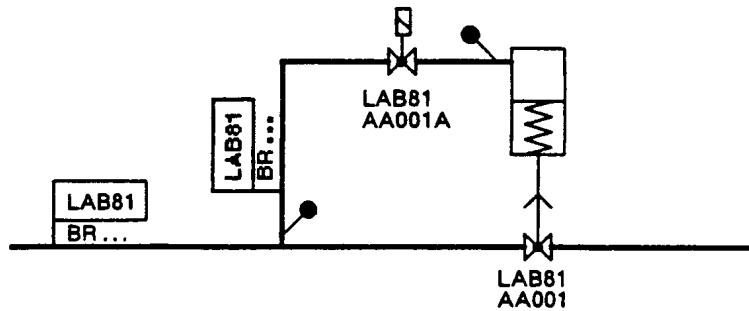
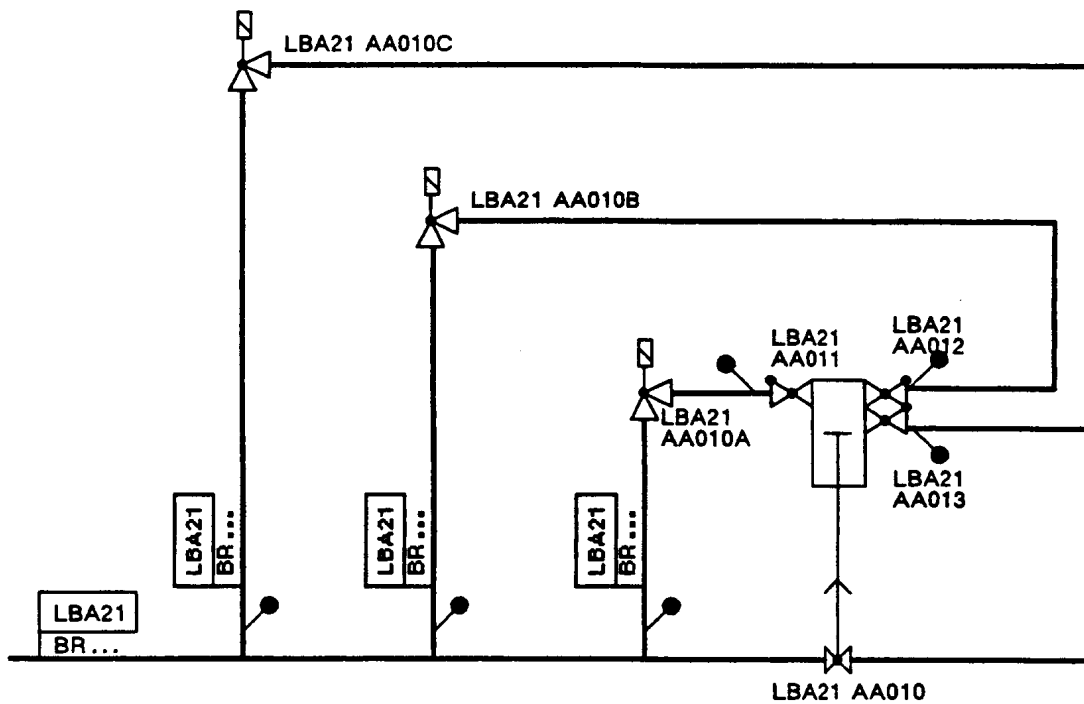
- Identification of pilot valves (described below)
- Identification of multiple drives and multiple supplies for electric loads (see Part B3 of the Application Commentaries)
- Identification of measuring circuits which share one sensor (see Parts B3 and B4 of the Application Commentaries)

The additional code is not an alternative code for the components identified under breakdown level 3.

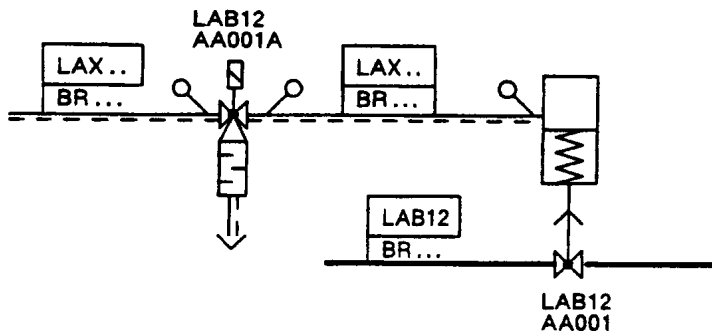
□ Identification of pilot valves:

It is reasonable to 'number' pilot valves in A₃ so that their correlation with the main valve is clearly apparent from the code.

This identification convention can be applied to both system fluid-operated and external fluid-operated pilot valves.

Example 45: System fluid-operated pilot valve (energize-to-trip)**Example 46:** System-fluid-operated safety valve with solenoid pilot valves in 1-of-3 configuration (energize-to-trip)

The three ball check valves shown above and any other isolation valves in the pilot lines which are provided for testing purposes only do not have pilot functions and are numbered in A_N .

Example 47: Pilot valve, external fluid-operated

At variance with Section 5.3 of the Application Guidelines, external fluid-operated pilot valves receive the system code of the main valve in order to indicate their association. External fluids are considered to be any fluids provided by general-purpose supply systems such as QF "General control air supply" or by a control fluid supply or associated with just one main group F₁(e.g. MX.) or F₂ (e.g. LAX).

Another method of identifying main and pilot valves is to use the A_N number. However, this does not establish the correlation of the pilot valve with the associated main valve. Correlation is nevertheless to a certain extent possible if appropriate numbering systems are used such as:

Main valve	AA010
Pilot valve 1	AA011
Pilot valve 2	AA012

3.3 Breakdown Level 3, Component Code

In mechanical engineering the component code subdivides equipment units into separate components.

The component code consists of component classification and numbering elements.

Breakdown level 3 may only be used in conjunction with breakdown levels 1 and 2 and is exclusively employed together with the process-related code.

Breakdown level 3 is not usually entered on system flow diagrams; in other documents its use is subject to agreement between the parties to the project.

3.3.1 Component Classification

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

Component Classification

Classification of components, signals or signal applications as per KKS Key

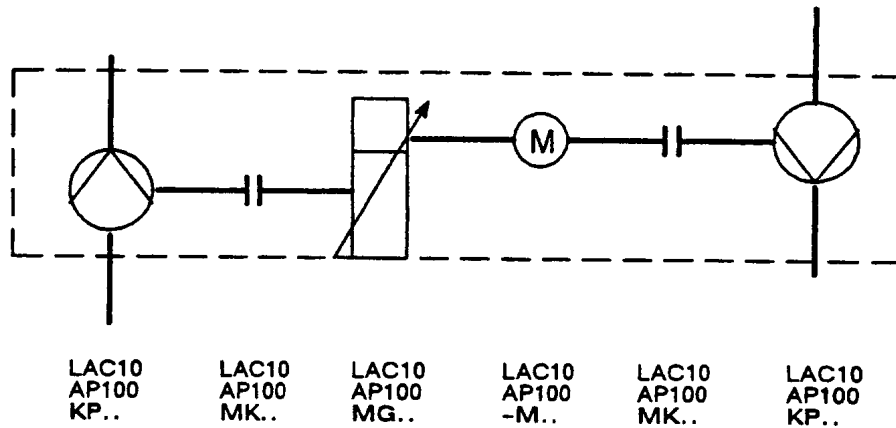
Coding letters and designations of main groups B₁:

- K** Mechanical components
- M** Mechanical components
- Q** Control and instrumentation components (non-electrical)
- Electrical components

Details on **Q** and **-** are given in Parts B3 and B4 of the Application Commentaries. The code **-** for electrical components is adopted from DIN 40719.

The coding letters and the associated designations for subgroup B₂ are given in the applicable Component Key.

Example 48: Components of feedwater pump mechanical equipment unit LAC 10 AP100



Component designations:

- KP** Pumps
MG Gearboxes
MK Clutches, couplings
-M Motors

3.3.2 Component Numbering

Serial no. of breakdown level	0	1	2	3
Titel of breakdown level	Total plant	System code	Equipment unit code	Component code
Designation of data character	G	F ₀ F ₁ F ₂ F ₃ F _N	A ₁ A ₂ A _N A ₃	B ₁ B ₂ B _N
Type of data character =	A or N	N A A A N N	A A N N N A	A A N N

Component numbering

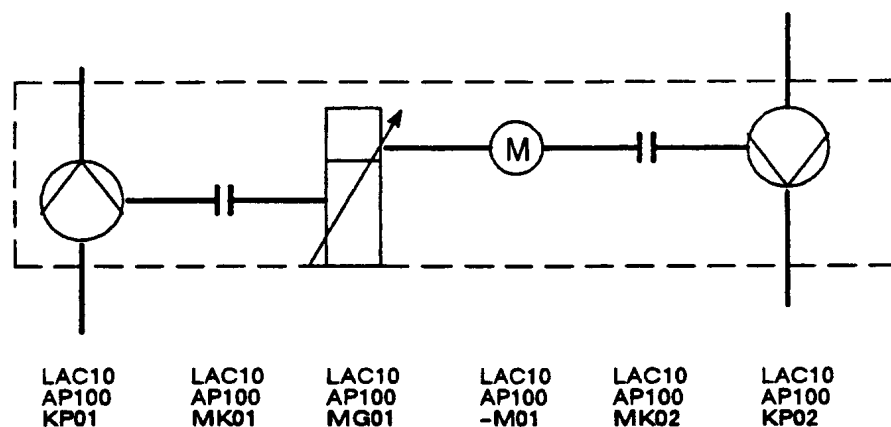
Numbering of components, signals and signal applications

B_N numbering is governed by the following principles:

- B_N numbering starts anew when the preceding system or equipment unit code or the component classification code element changes.
- B_N numbering may be governed by priorities (e.g. main and booster pump).

In all events it is necessary to ensure that numbering conventions, once established, may not be altered as of a specific state of progress in planning since contingent changes incur great expense.

Example 49: Numbering of components of feedwater pump mechanical equipment unit LAC10 AP100



Component designations:

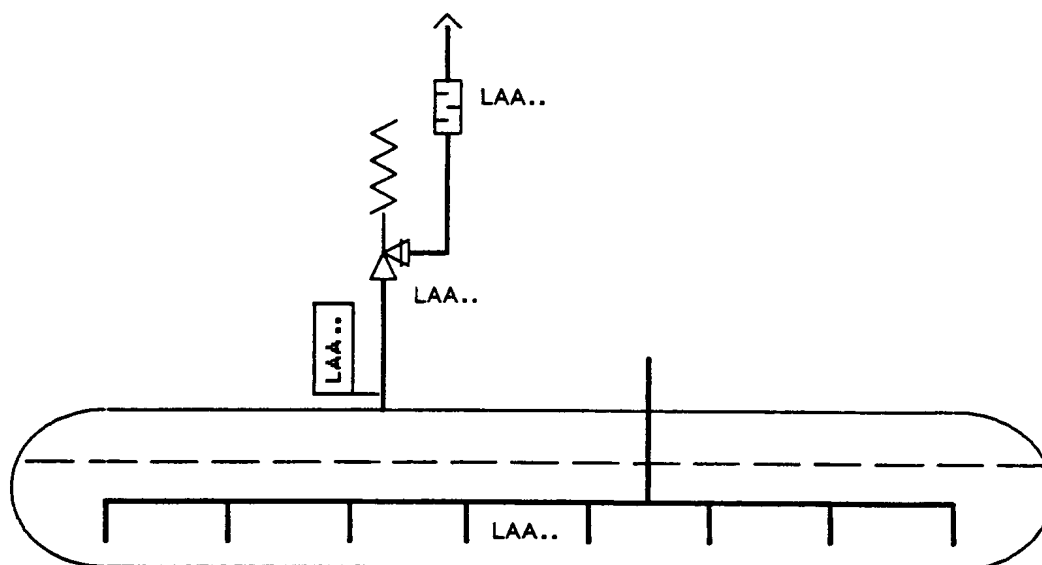
KP01	Main pump
KP02	Booster pump
MG01	Gearbox
MK01	Coupling of main pump
MK02	Coupling of booster pump
-M01	Motor

4 Assignment of Mechanical Equipment and Measuring Circuits to Systems

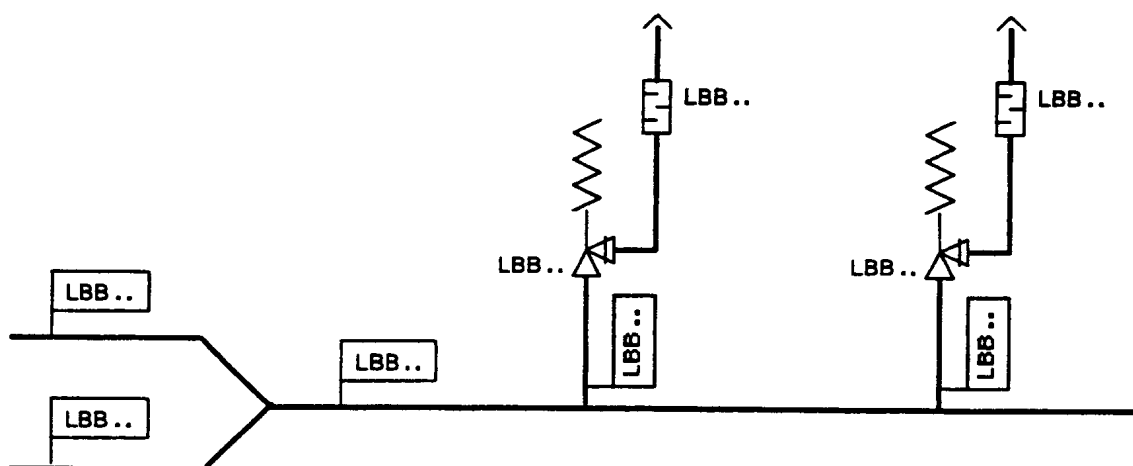
4.1 Safety Equipment

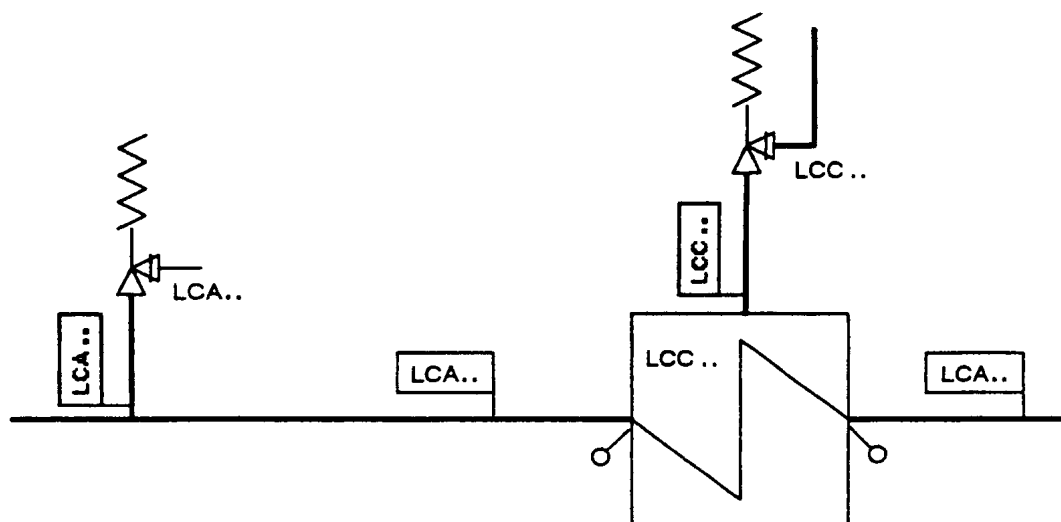
Safety equipment, consisting of safety valves and their associated piping, is assigned to the system to which they are connected.

Example 50: Safety equipment of feedwater tank



Example 51: Safety equipment of hot reheat line

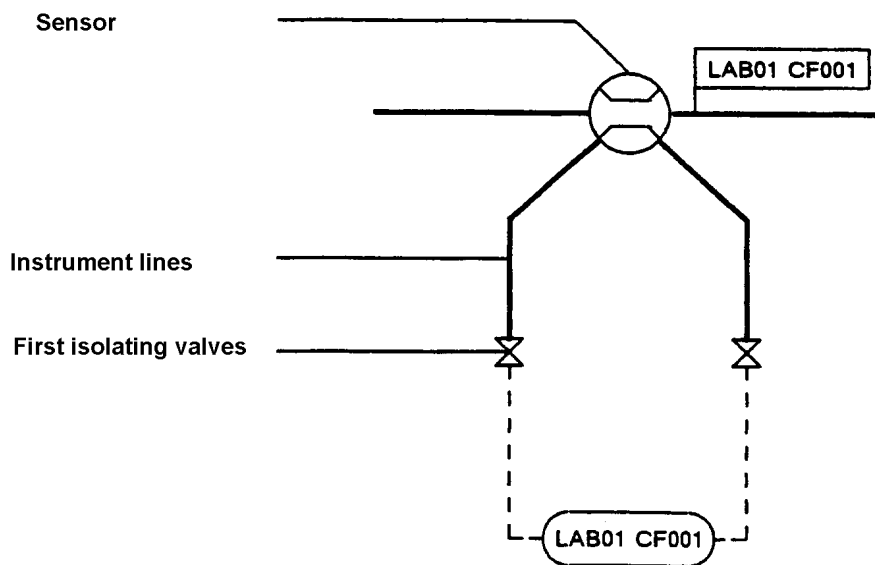


Example 52: Tube and shell-side safety equipment of LP feedwater heaters**4.2 Measuring Circuits**

Measuring circuits are identified according to the system or plant in which the sensor is installed. The mechanical portion of a measuring circuit consists of sensors, instrument lines and first isolation valves. The control and instrumentation portion of a measuring circuit consists of transducers, signal lines inclusive of the valve bank downstream of the first isolation valves, and the control and instrumentation devices for analog signal processing.

The following can be identified in system flow diagrams:

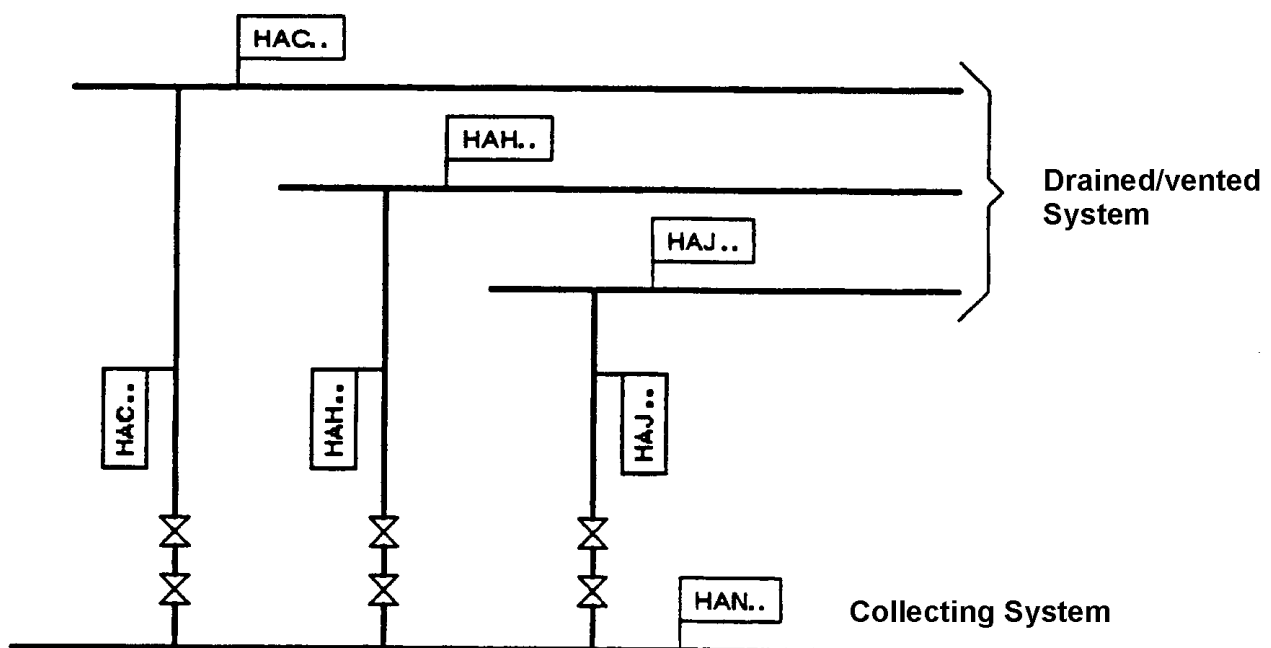
- Sensors
- Instrument lines
- First isolation valves, or double isolation valves in high-pressure systems
- Alternative symbol, e.g. "C & I loop to DIN 19227"

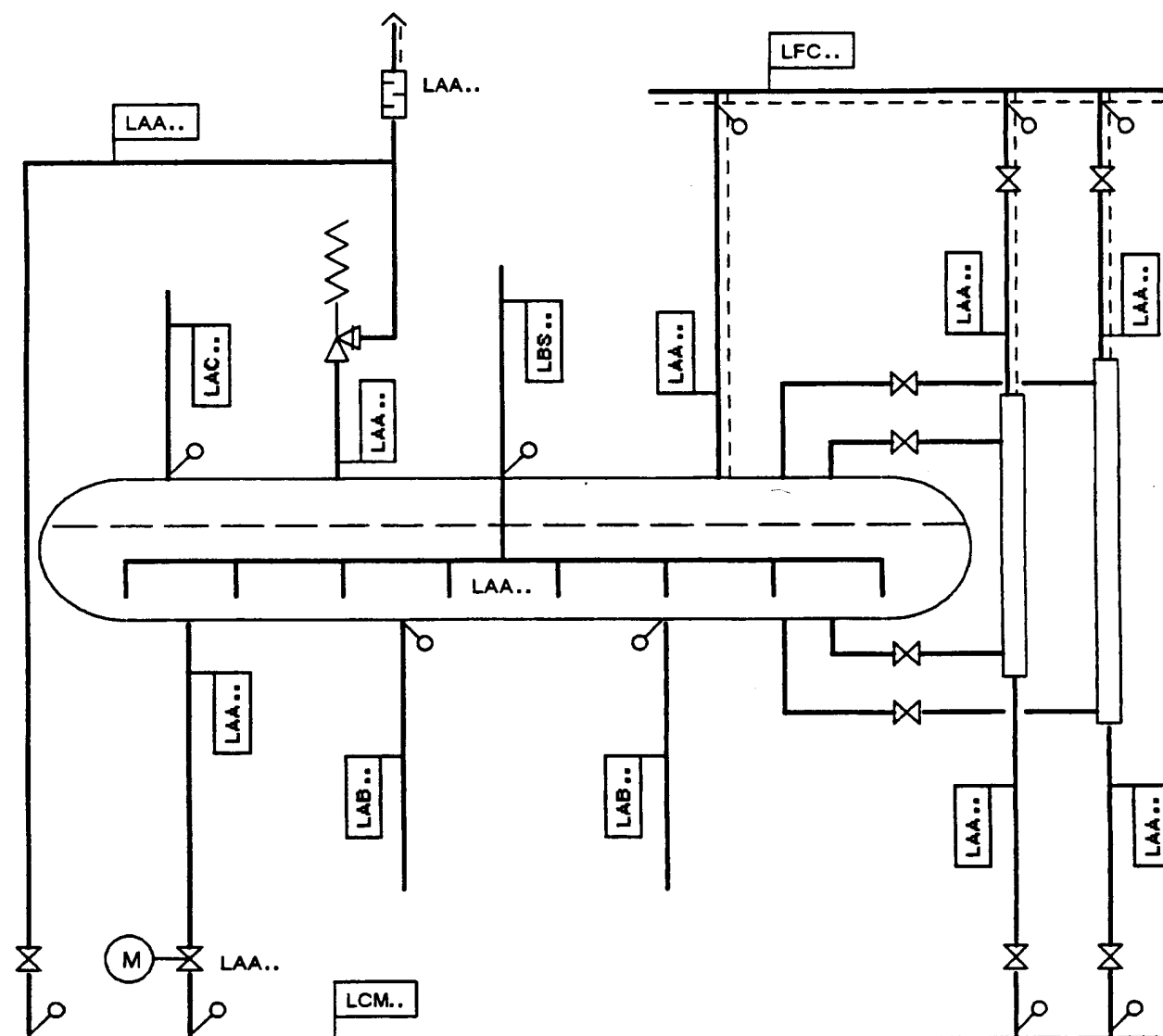
Example 53: Instrument arrangement

Further details on the identification of measuring circuits are contained in Parts B3 and B4 of the Application Commentaries.

4.3 Drains and Vents

Drains and vents are identified as far as the discharge into a collecting system or open outlet, or as far as the final isolation element, as part of the drained or vented system. The collecting system proper, which is identified as a subgroup F₃ of the system code, starts at the collecting point (e.g. tundish, header, collecting tank, ring main).

Example 54: Drains and vents of steam generator pressure system

Example 55: Drains and vents of feedwater storage, deaeration system

4.4 Supports

Anchors (anchor plates, etc.) are generally permanently attached to the structure concerned and are identified according to the pertinent structure on breakdown level 1. Further identification is subject to agreement between the parties to the project.

Supports which serve one system only may receive the same classification as the system. Where several systems with different codes are attached to one support, the support may receive the classification breakdown level 1 of the structure or according to the most important system.