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Compiled by

J. Mathebula

Senior CM Technician

Approved by

Keoagile tiro

Drawing Office: Middle Manager

Authorised by

L. Fernandez

Asset Information Management: Senior Manager

Date: 2020/06/18

Date: 19/06/2020

Date: 2020/07/01

Supported by SCOT/SC/TC

Mmabatho Gabonewe
SCOT/SC/TC Chairperson

Date: 22/06/2020

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1. INTRODUCTION

Plant Coding is the cornerstone of the configuration management and other management information systems. It is of utmost importance that standardised application thereof is used. Standardized application of coding across Eskom's Plants is critical in eliminating non-uniform identification of plant, system, equipment and components in all power stations.

The principle is to use the latest Kraftwerk Kennzeichnen System (KKS) coding as defined by the Technische Vereinigung der Grosskraftwerk Betreiber E.V (VGB) organisation, of which Eskom is a member. Deviations from the VGB standards are not permitted, and if the VGB codes prove to be unsuitable for a specific plant type or configuration, Eskom will make application to the relevant VGB Technical Committee for a solution.

2. SUPPORTING CLAUSES

2.1 SCOPE

This standard specifies the rules and guidelines that shall be followed in KKS identification of plant, systems, equipment and components in all Eskom's KKS power plants. It outlines the specifications for identification in different engineering disciplines (i.e. mechanical, electrical, civil and control & instrumentation).

It covers KKS plant coding applicable in gas, hydro, pumped storage and solar power plants. Nuclear and wind power plant coding is not covered in this standard.

2.1.1 Purpose

The purpose of this document is to establish a standardized KKS coding rules for identification of plant, systems, equipment and components in all Eskom's KKS power plants.

2.1.2 Applicability

Application of KKS Coding Standard is mandatory in all coal, gas, hydro and solar power plants unless otherwise stated. All parties working with Engineering and Generation shall comply with the contents of this document.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Throughout this Standard, the following dated and undated standards are referred to. These normative and informative referenced documents shall, to the extent specified herein, form a part of this standard.

2.2.1 Normative

- [1] VGB-B 105E 7th Edition 01/2010 KKS Guidelines
- [2] VGB-B 106A E Part A Edition 2004 KKS Application Explanations
- [3] VGB-B 105E-KKS Part B1 Identification in Mechanical Engineering.
- [4] VGB-B 105E-KKS Part B2 Identification in Civil Engineering.
- [5] VGB-B 105E-KKS Part B3 Identification in Electrical, Control and Instrumentation Engineering.
- [6] VGB-B 105E-KKS Part B4 Identification in Control and Instrumentation in Process System.
- [7] VGB-B 106D1 KKS Application Explanations for Hydro Power Plants

2.2.2 Informative

- [8] DIN 40719 Part 2 (IEC 750)
- [9] [240-109607736](#) KKS Key Part Standard

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- [10] [240-53114190](#) Internal Audit Procedure
[11] [240-53665024](#) Engineering Quality Manual
[12] [240-109607450](#) Plant Identification Work Instruction

2.3 DEFINITIONS

Definition	Description
Component	Specific machine consisting of parts that perform a certain action to support the operation of an equipment.
Equipment	Set of interacting machines and/or components that perform specific action within a plant process system or network system
Functional Group	A functional group integrates all related plant and field equipment required to make that piece of the plant operational.
Key Part	Key Part is a plant classification system catalogue of KKS Codes to be used to classify power plant structures, systems, equipment and components.
KKS Code	The KKS Code is an approved identification code for power plants, sections of the plant, equipment, items of the equipment and its consists of alpha letters (A) and numbers (N). The code is divided in four (0-3) BDL's in the process related code and in three (0-2) BDL's in the point of installation code and the location code.
Plant	Industrial site consisting of systems of technology used to perform specific set of functions.
Plant Breakdown Structure	The hierarchical structure developed to breakdown a plant in relation to its systems, subsystems and components.
Plant Coding	It is an approved system of identifying the plant, plant items such as systems, subsystems and components.
Power-Plant/Station/house	Power station/plant or powerhouse is an industrial facility for the generation of electric power.
System	An organized, purposeful structure that consists of interdependent and interrelated equipment. i.e. pumping system, Boiler system, etc.

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS AND CODES

Abbreviation	Description
BDL	Break Down Level
CE	Electrical quantities according to the KKS Key Part
CM	Configuration Management
CSP	Concentrated Solar Power
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
KKS	Kraftwerk Kennzeichnen System (German term for Power plant Classification system)
kV	Kilovolt
OCGT	Open Cycle Gas Turbine
P&ID	Process and instrumentation diagram

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Abbreviation	Description
PBS	Plant Breakdown Structure
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
Rev	Revision
SOC	State Owned Company
V	Volt
VGB	Technische Vereinigung der Grosskraftwerk Betreiber E.V (Major Power Plant Users Association)
Code	Description
A ₁ A ₂	Equipment code classification
A ₃	Equipment code subdivision
A _N	Mechanical, electrical and C & I equipment numbering
B ₁ B ₂	Component classification (component key)
B _N	Component numbering
F ₁ F ₂ F ₃	Function/installation unit/structure classification element
F _N	System/installation unit/structure subdivisions
F _o	Identical systems/installation units/structures in a unit
G	Total plant

2.5 ROLES AND RESPONSIBILITIES

It will be the responsibility of the Configuration Management Manager to control and manage the contents and implementation of this standard. Coding practitioners shall be responsible for the application of codes on plants, systems, equipment and components. Contractors and Eskom employees shall apply codification system as stipulated in this standard.

2.6 PROCESS FOR MONITORING

This document shall be monitored through Internal Audit Procedure (240-53114190) as well as Engineering Quality Manual (240-53665024).

This document shall be reviewed every 3 years from the last date of issue or when there are significant changes to the applicable VGB standards.

2.7 RELATED/SUPPORTING DOCUMENTS

All referenced documents.

3. KKS CODING RULES AND STRUCTURE

3.1 BASIS OF KKS

The purpose of the KKS coding rules for Power Plants is to identify plants, sections of plants and items of equipment according to task, type and location, as defined in VGB-B 105E 7th Edition 01/2010 KKS Guidelines [1]. It is to be used by all engineering disciplines for planning, construction, operation and maintenance. The KKS coding system was developed taking IEC and ISO standards together with the DIN 40719 Part 2 (IEC 750) [8] into consideration. KKS guidelines were formulated with the following objectives and considerations:

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- Uniform identification for all types of power stations and any connected processes.
- Sufficient capacity and detail for identification of all systems, equipment, components and structures.
- Sufficient capacity for extension to accommodate new technologies.
- Interdisciplinary applicability to mechanical, civil, electrical engineering, control and instrumentation combined with ability to identify according to process functions, points of installation and locations.
- Consideration of the national and international standards.
- Non-language based to ensure international usability.

The KKS guidelines do not contain rules on:

- Combination of the code with other identification systems (This shall be covered in power station specific coding standards).
- Methods of marking, e.g. in control rooms, local control stations, labelling off components and identification of documents.
- Open text abbreviations.

3.2 SCOPE OF KKS CODING

This KKS coding standard specifies the identification plant systems, equipment and components in all Eskom's KKS power plants. KKS coding identification system shall be allocated according to their function, type and location, in relation to KKS Key Parts definitions and the VGB guidelines.

As a minimum, all plants shall be coded as follows:

- According to process functions: All plant shall be coded to KKS breakdown level 3.
- According to points of installations: Electrical and instrumentation devices in installation units (e.g. cabinets, panels, console) shall be coded to KKS breakdown level 3.
- Location code: Plant structures shall be coded to KKS breakdown level 2.
- Cables coding: Cables shall be coded with either source or destination equipment KKS Code followed by a sequential four-digit number and optional four alpha characters.

3.3 TYPES OF CODES

KKS as defined by the VGB has three different types of codes to satisfy various requirements employed on the identification of plants, sections of plants and items of equipment in power stations, which can be used together or separately. These codes are the process-related code, the point of installation code and the location code. These codes are subdivided into three and four Break Down Levels (BDL).

3.3.1 Process-related code

Process/function related identification of systems and items of equipment according to their function in mechanical, civil, electrical and control and instrumentation engineering. Examples are pipes, pumps, valves, motors, measurements, switches, transformers etc.

3.3.2 Point of installation code

Identification of points of installation of electrical and control and instrumentation equipment in installation units e.g. in cabinets, panels, consoles, etc.

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3.3.3 Location code

Identification of locations of various structures, such as dams, tunnels, buildings, floors, rooms and fire areas. This code is used to identify the location of mechanical components in the same manner as the point of installation code is used in electrical and control and instrumentation engineering.

The three type of codes use the same hierarchically structured identification pattern, which are subdivided into a maximum of four breakdown levels.

The following Figure 1 shows the role of the codes on different BDL's.

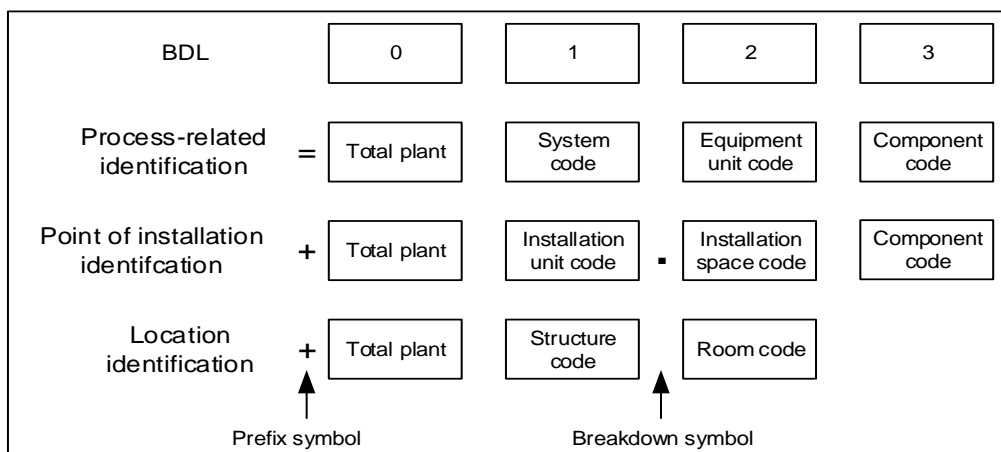


Figure 1: Break down levels for various types of codes

KKS Codes are recognized by a prefix symbol in front of level 0 and a breakdown symbol in accordance with DIN 40719, Part 2 as follows:

Process-related identification symbol '='

Point of installation identification symbol '+'

Location identification symbol '+'

The "full stop" breakdown symbol for point of installation identification must always be written. The prefix symbols may be omitted if the information content of the codes remains unambiguous.

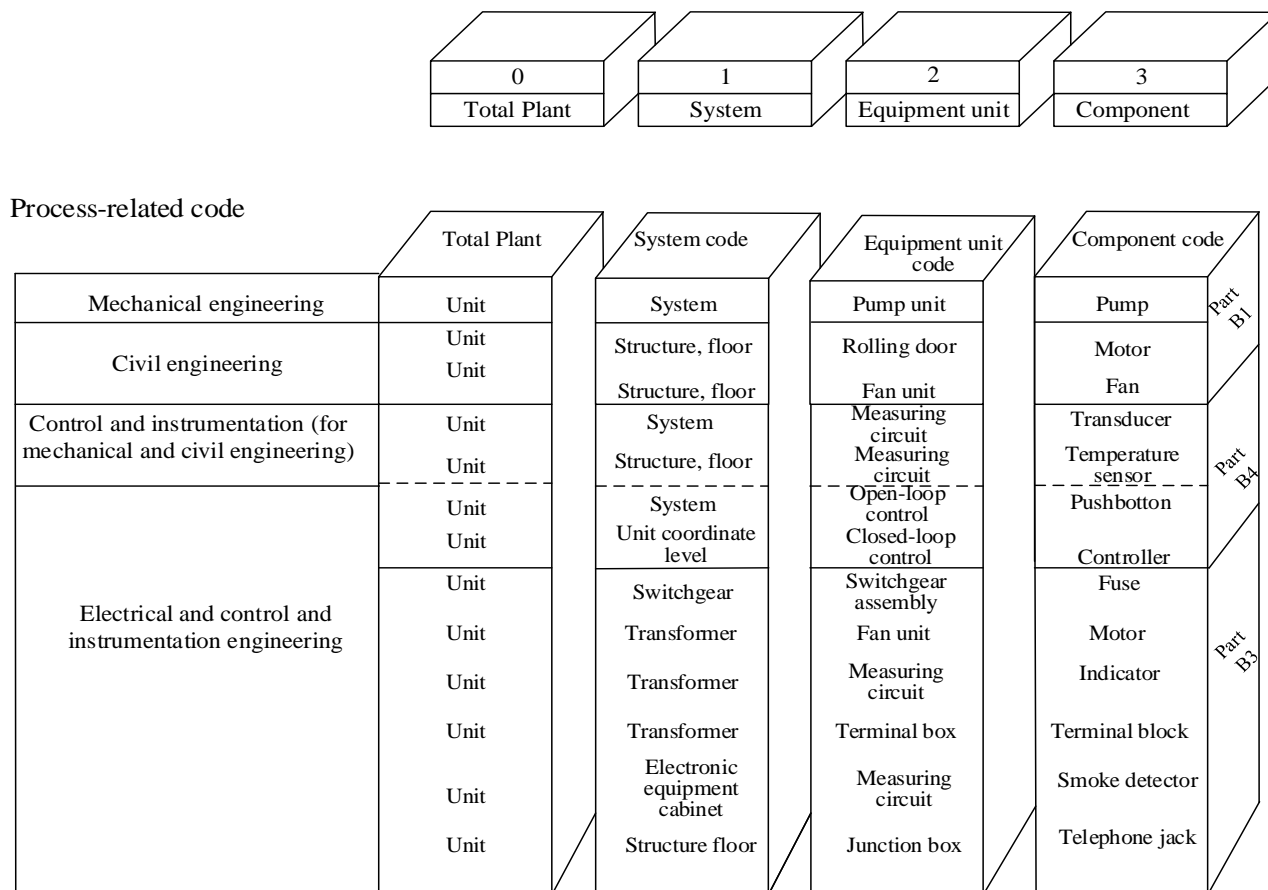


Figure 2: Correlation of the examples with the engineering disciplines for process-related code

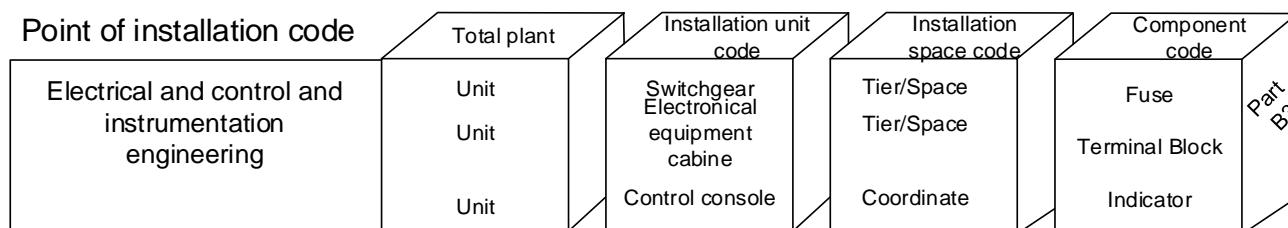


Figure 3: Correlation of the examples with the engineering disciplines for point of installation code

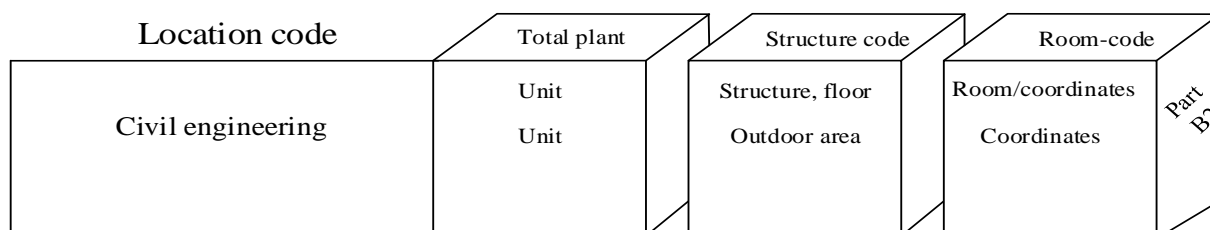


Figure 4: Correlation of the examples with the engineering disciplines for location code

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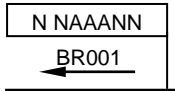
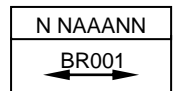
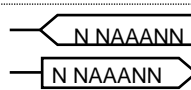
3.4 NOTATION OF CODES

Codes shall be written with single spacing between break down levels (unit, system, equipment and component) to avoid misinterpretation as shown below:

N NAAANN AANNNA AANN

3.5 KKS RELEVANT SYMBOLS IN P&ID's AND PRINCIPLE SKETCHES

In P&IDs, the following symbols indicate KKS Code, limit functions and piping sections:

	The symbol "pin with empty head" is used to identify the limits of functions and sub-functions. A typical implementation is the change of the following functions: G, F ₀ , F ₁ /F ₂ /F ₃ , F _N .
	The symbol "pin with full head" is used to identify the limits of piping sections. A typical implementation is the change of the following pipe subsystem: B _N .
	The "flag" symbol is used to present the marking of pipelines. The direction of the flag indicates the medium flow direction.
	The extended "flag" symbol is used to present the marking of pipelines in which the medium flow direction changes according to the operating condition.
	The "connection reference" symbol indicates incoming or following systems. The symbol pointer between connected systems represented on different P&IDs contains BDL System Code as minimum information.

3.6 COUNTING DIRECTION PRIORITIES

Counting and numbering in all KKS Coded Power plants shall be governed by the following principles:

- Direction of numbering shall be established based on the direction of flow of energy and materials as often as possible.
- Numbering shall start anew when one of the preceding code element changes.
- Numbering shall be done in units or decades depending on the system, that is being used.
- Numbering direction inside the unit shall be from left to right, bottom to top, front to rear or inside to outside but the direction of flow takes precedence over physical position of the plant. In cases where this is not clear, the P&ID should be referred to.

3.6.1 Counting Rules Within a Unit

- Counting directions within a boiler house shall be determined from a position facing the boiler as shown in Figure 5.
- Counting directions within a turbine house shall be determined from a position facing the turbo-generator as shown in Figure 5.
- Counting direction for common plant (outside unit) shall be determined from a position facing the power station from across the HV yard as shown in Figure 6.

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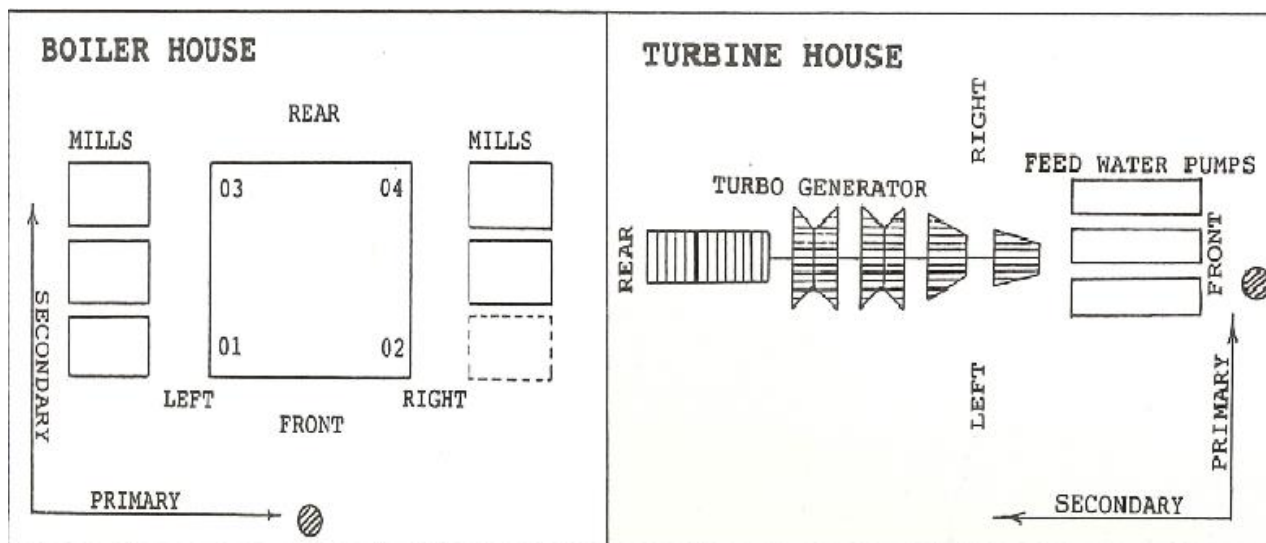


Figure 5: Boiler and Turbine House counting directions

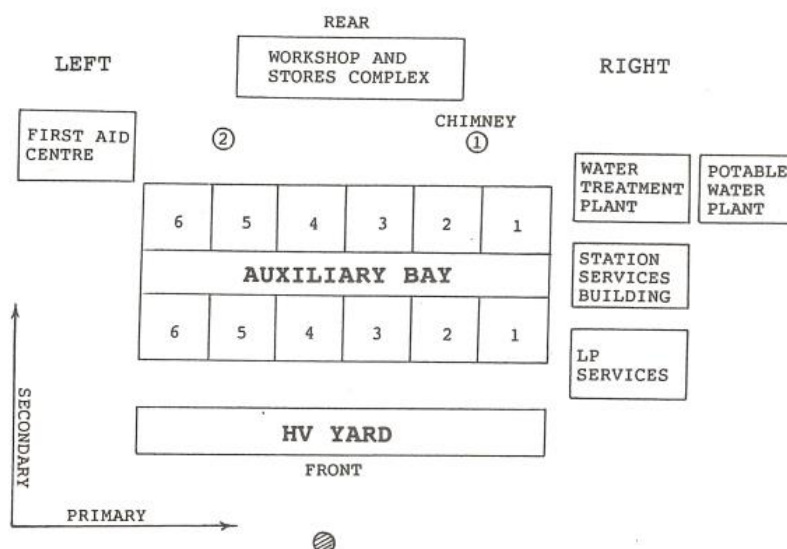


Figure 6: Common Plant counting directions

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4. PROCESS RELATED IDENTIFICATION

4.1 KKS CODE STRUCTURE

The KKS Code structure shall be according to the VGB standards, rules and guidelines.

The KKS Code consists of alpha letters (A) and numeric(s) (N). The code is divided into 4 (0-3) BDL's in the process related code. The individual BDL are differently formatted. They consist of classifying and numbering code elements. The alpha code elements F_1 , F_2 , F_3 , A_1 , A_2 , and B_1 , B_2 have a classifying function. The code elements G , F_0 , F_N , A_N , A_3 and B_N have a numbering function.

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	System code			Equipment code			Component code	
Data character	G	F_0	$F_1F_2F_3$	F_N	A_1A_2	A_N	A_3	B_1B_2	B_N
Type of key	N	N	AAA	NN	AA	NNN	A	AA	NN

4.2 CONTENTS OF DATA CHARACTERS

4.2.1 Break Down Level 0 (Total Plant)

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	System code			Equipment code			Component code	
Data character	G	F_0	$F_1F_2F_3$	F_N	A_1A_2	A_N	A_3	B_1B_2	B_N
Type of key	N	N	AAA	NN	AA	NNN	A	AA	NN

Total Plant:

Total Plant (G) shall be used to represent a common plant or a plant unit within a power station and this shall apply to all Eskom KKS green-field power plants.

The position G defines unit number(s) or common plant:

G=0 for any common plant

G=N N indicating plant unit number (For power generating plant, a 'Unit' is defined as an entity that can be independently connected to the grid for purposes of power generation).

Coding in all Eskom power plants shall use numeric characters (N) on total plant coding, and alpha (A) when there are more than 9 units.

Table 1: Total Plant Coding

Total Plant	Coal power plant	Hydro power plant	Gas power plant
G=N	Power station unit	Power station unit	Power station unit
G=0	Common Plant	Common Plant	Common Plant

The data character G does not change irrespective of the power plant type as shown in Table 1.

Coal plant unit numbering shall be from left to right from a position facing the flow direction of material and energy (coal in, electricity out) as shown in Figure 7.

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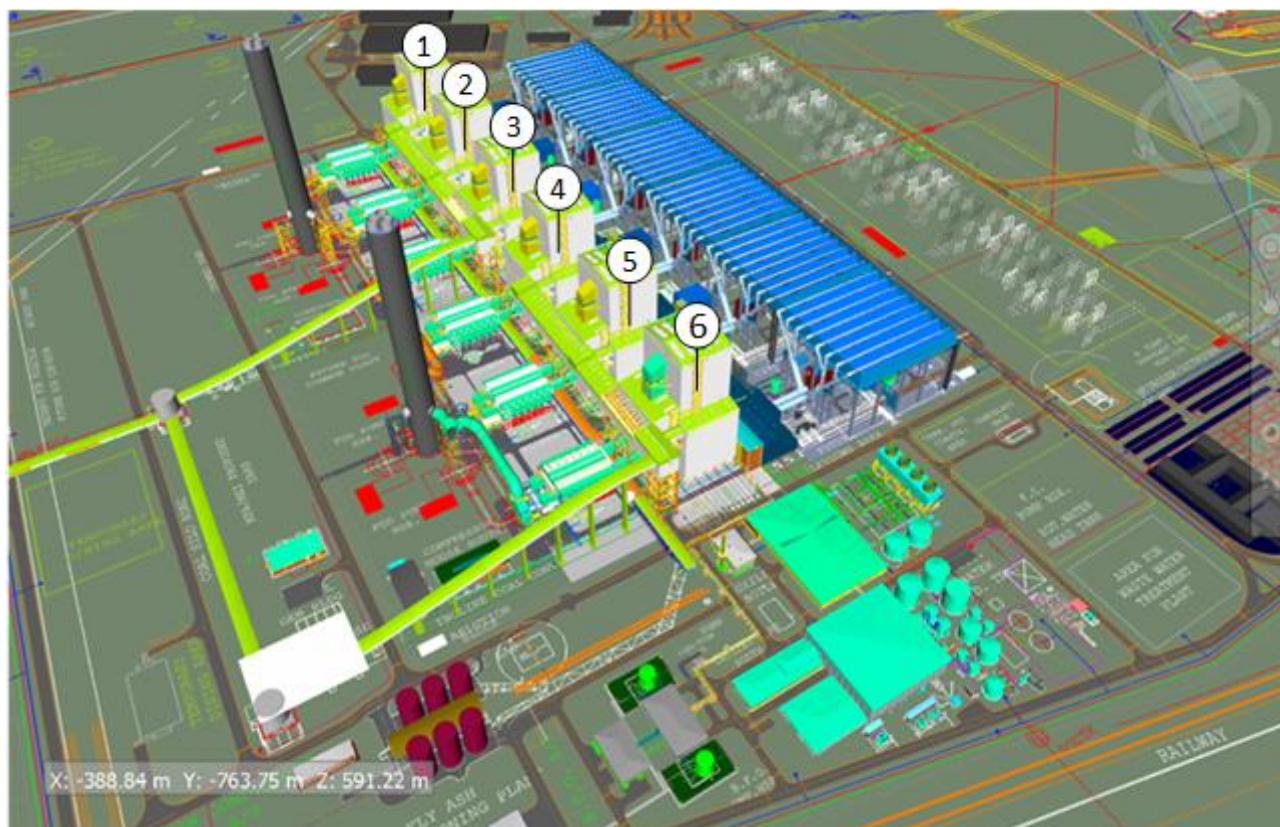


Figure 7: Total plant unit numbering in coal power plant

Hydro power plant unit numbering shall be from left to right facing the direction of flow of water.

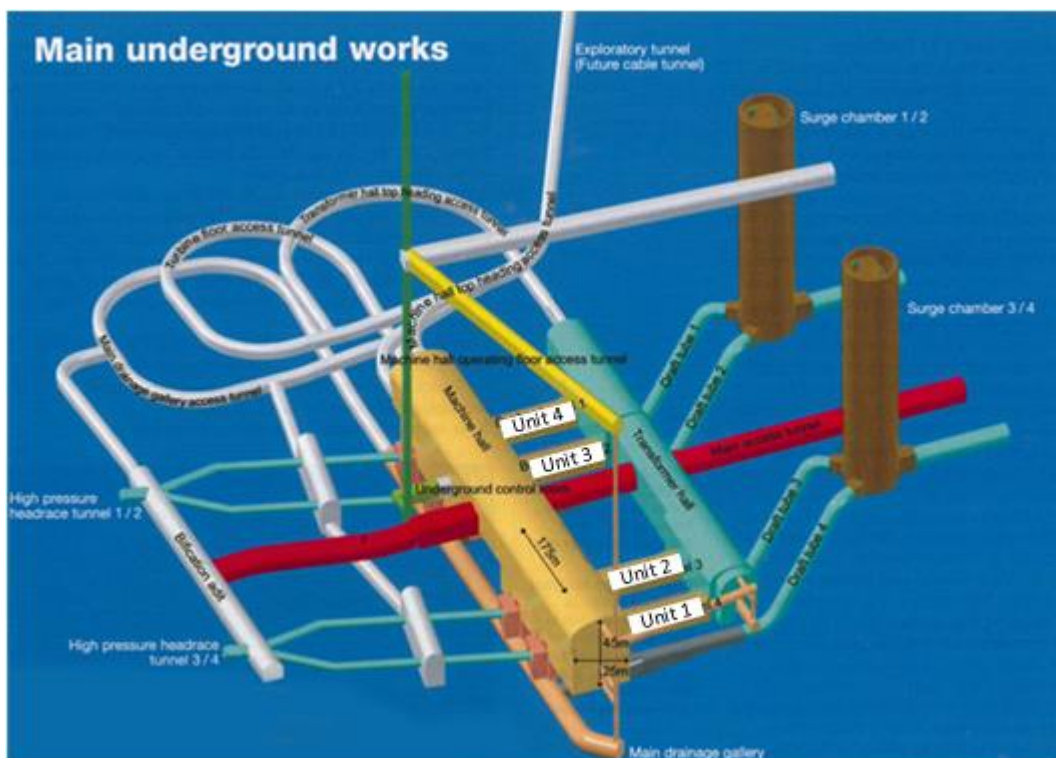


Figure 8: Unit numbering in hydro power plant

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4.2.2 Break Down Level 1 (System code)

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	System code			Equipment code			Component code	
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 key	N	N	AAA	NN	AA	NNN	A	AA	NN

The system code subdivides the total plant into main systems. It consists of the prefix (F₀) and function classification element (F₁, F₂, F₃) as well as the numbering element (F_N).

The first character in this BDL (F₀) shall be used to subdivide identical systems in (F₁ - F₃), which have to be coded separately. When there is one system then this position shall be coded as 0 (zero). When there are more than one system they shall be numbered in units (e.g. 1, 2, 3...), and in the case of refurbishment additions, the numbering shall be extended from the existing numbers.

The classification codes for (F₁, F₂, F₃) are specified in the 240-109607736 KKS Key Part Standard [9] and no deviations shall be permitted. If the KKS Codes do not suit the particular technology or plant type, Eskom will formally approach the VGB for additions to the Key Part. It is not permitted to use keys that are "blocked" in the code.

Coding letters and designations of the main groups F₁ applicable to coal, gas and hydro power plants as given in the KKS Key Part:

- A** Grid and distribution
- B** Power transmission and auxiliary power supply
- C** Instrumentation and control equipment
- D** Blocked
- E** Conventional fuel supply
- F** Handling of nuclear equipment
- G** Water supply and discharge
- H** Conventional heat generation
- J** Nuclear heat generation
- K** Nuclear auxiliary system
- L** Water, steam and gas cycle
- M** Main machine set
- N** Process energy supply for external users (e.g. district heating)
- P** Cooling water system
- Q** Auxiliary system
- S** Ancillary system
- T** Blocked
- U** Structure
- V** Blocked
- W** System for regenerative energies

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X Heavy machinery (not main machine sets)

Y Blocked

Z Workshop and office equipment

The coding letters T, V and Y shall not be used as they are blocked by VGB for future use. Coding letters I and O shall not be used as stipulated by the VGB guidelines.

Table 2: Coding letters and designations of the main group F₁ as given in the KKS Key Part

		Types of Power Station			
		Coal	Hydro	Gas	Solar
System Classification (F ₁)	A	x	x	x	x
	B	x	x	x	x
	C	x	x	x	x
	E	x		x	x
	G	x	x	x	x
	H	x			x
	L	x	x		x
	M	x	x	x	x
	P	x	x	x	x
	Q	x	x	x	x
	S	x	x	x	x
	U	x	x	x	x
	W				x
	X	x	x	x	x
	Z	x	x	x	

“x” denotes applicable function key.

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Example 1: Identification of a spray system in a process-related identification

Serial number of BDL	0	1	2	3
Title of BDL	Total Plant	System	Equipment Unit	Unit component
Example	Common plant	Spray water system	Pump unit	Pump
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
KKS Code	=0	0 SGC 10		

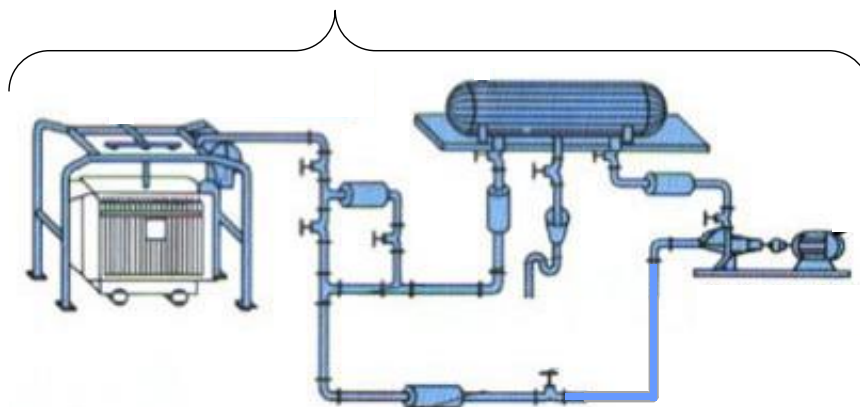


Figure 9: Spray system identification

Example 2: Identification of unit systems in a process-related identification

Serial number of BDL	0	1	2	3
Title of BDL	Total Plant	System	Equipment Unit	Unit component
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
KKS Code	=1	0 M		
		Main machine		
	=1	0 MA		
		Turbine system		
	=1	0 MAA		
		High pressure turbine		
	=1	0 MAB		
		Intermediate pressure turbine		
	=1	0 MAC		
		Low pressure turbine		
	=1	0 MKA		
		Generator rotor		
	=1	0 HA		
		Pressure part system		
	=0	0 EAC		
		Coal conveyor		

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The above examples are selected systems from a coal fired power plant displayed in Figure 10.

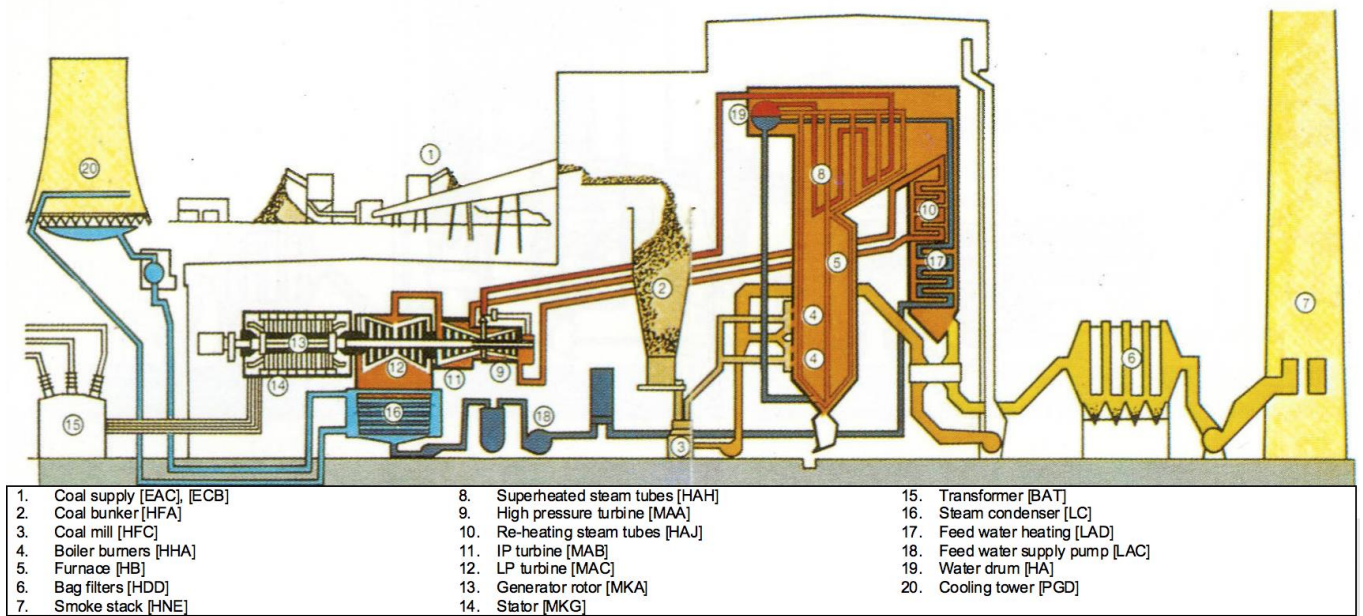


Figure 10: Unit systems identification for Coal Plant

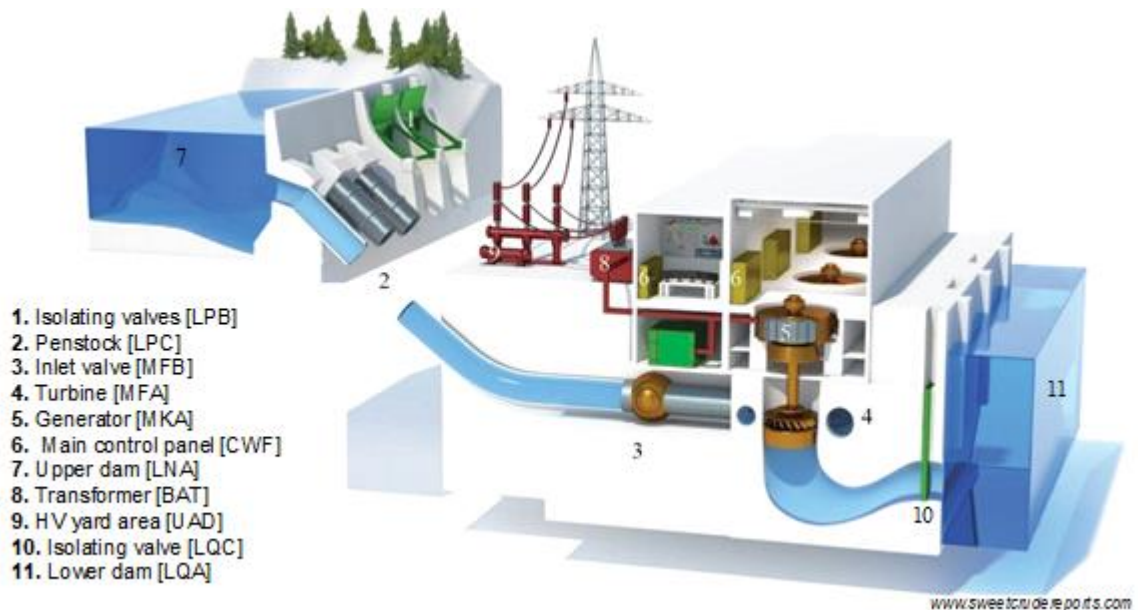


Figure 11: Unit systems identification for Pumped Storage Plant

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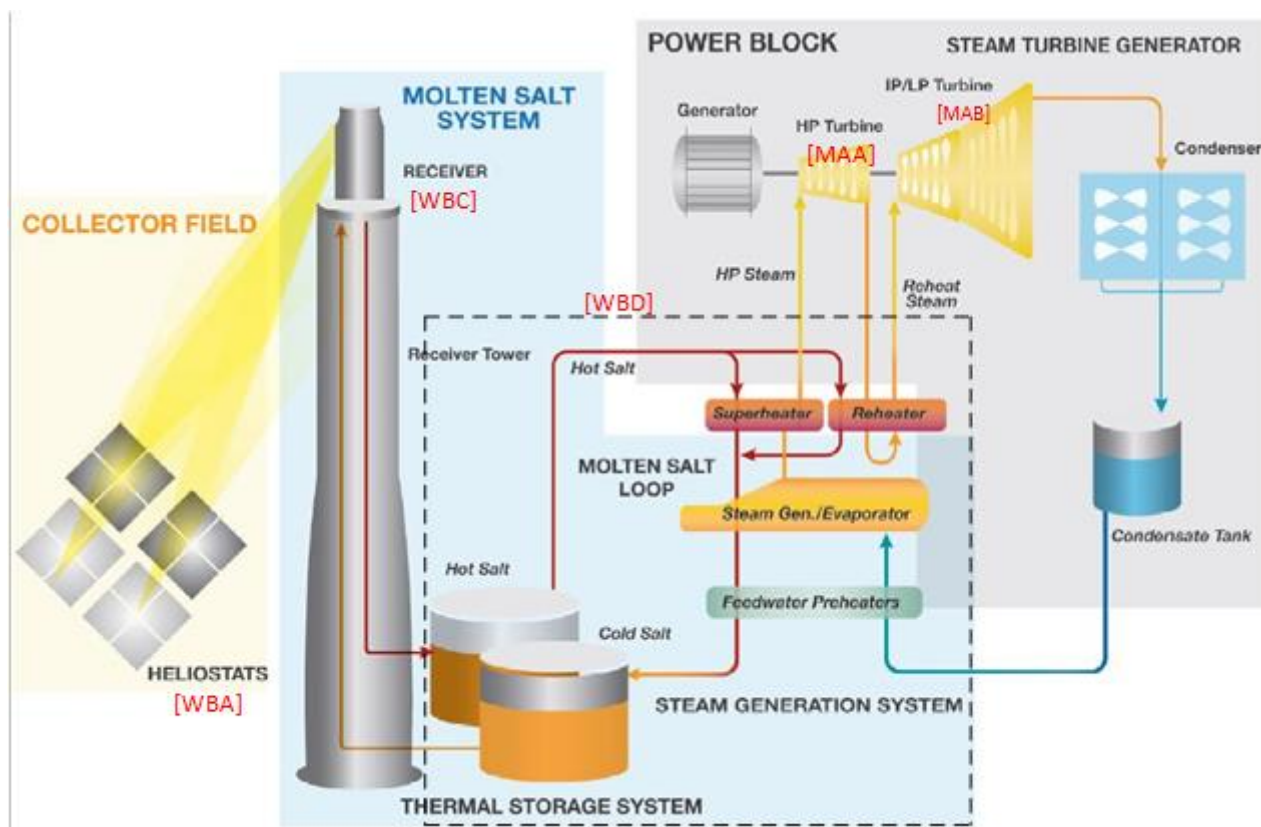


Figure 12: Concentrated Solar Power (CSP) Plant unit systems

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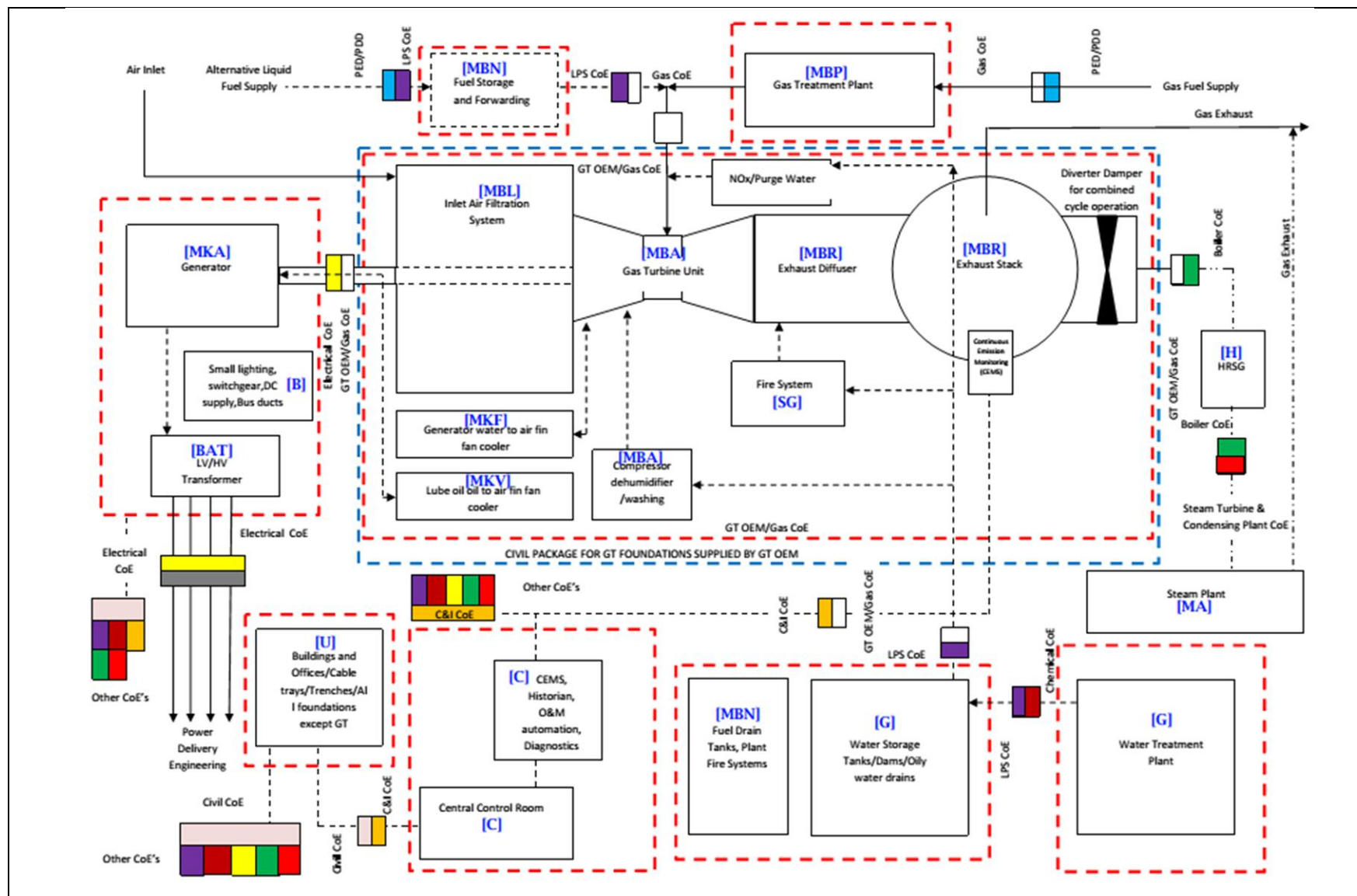


Figure 13: Identification of unit systems in Gas Power Plant

System Code F_N is a numbering code element which subdivides systems classified in $F_1F_2F_3$ into subsystems and system sections and plants into sections of plants. Its 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). The direction of F_N numbering must coincide as a rule with that of flow of fluid, energy or materials.

F_N numbering shall follow either consecutive or decadic numbering scheme (e.g. 21, 22, 23, etc for consecutive numbering and 10, 20, 30, etc. for each decadic numbering) as shown in Figure 14 and Figure 15.

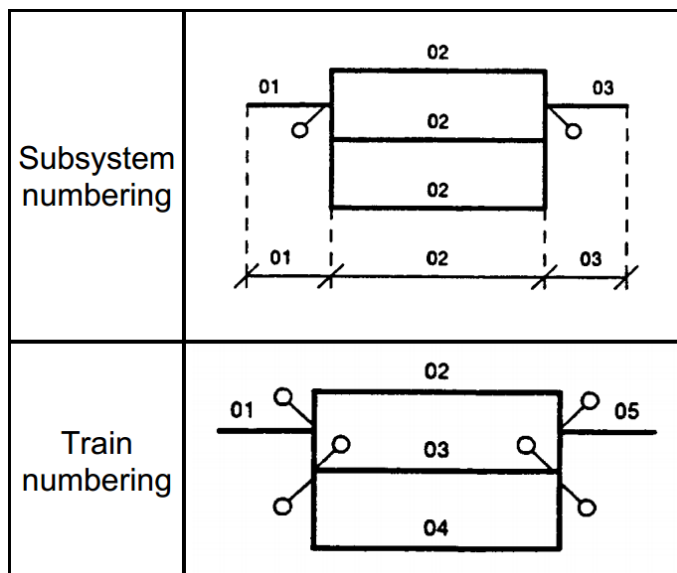


Figure 14: F_N Consecutive Numbering

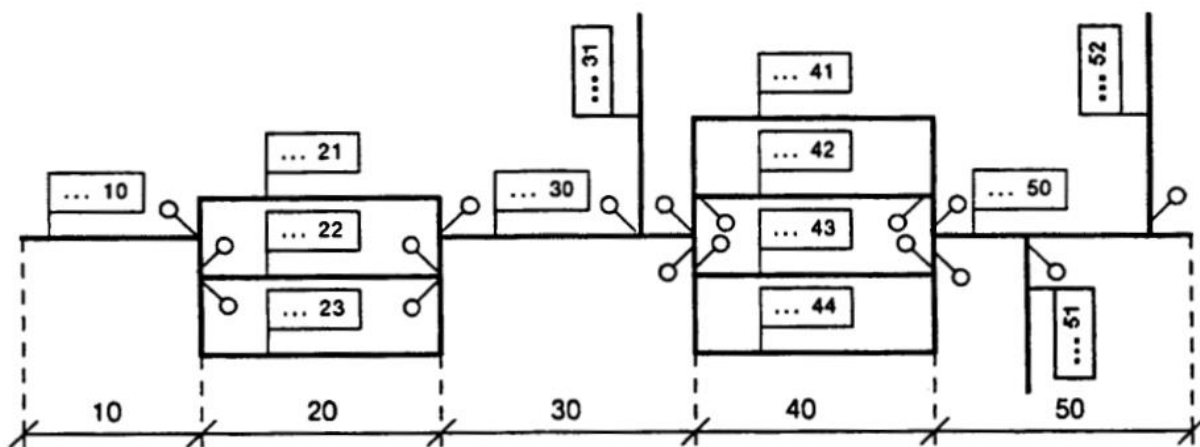


Figure 15: F_N Decadic Numbering

4.2.2.1 System code for Heavy Machinery

Certain 'components' such as steam turbines used as drives for feed water pumps can require so many identification details that, as 'Heavy machinery', they need separate system codes in order to permit identification of all associated mechanical equipment units and electrical, control and instrumentation facilities. The system codes for such heavy machinery are fixed as X in main group F_1 .

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4.2.2.2 Interfaces

There are sections of the Function Key which indicate interfaces as shown below:

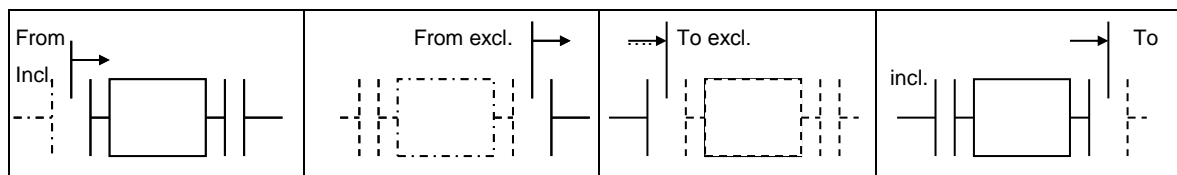


Figure 16: Interfaces

The boundaries definitions and meanings are given below:

Table 3: Interface definitions

Legends for the limits	
From 'incl'	Means including the mentioned component
From 'excl'	Means excluding the mentioned component
To 'excl'	Means excluding the mentioned component
To 'incl'	Means including the mentioned component

4.2.3 Break Down Level 2 (Equipment code)

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	System code			Equipment code			Component code	
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 key	N	N	AAA	NN	AA	NNN	A	AA	NN

The equipment unit code divides the system (BDL 1) into the relevant equipment. The equipment unit code consists of equipment unit classification A₁, A₂ and numbering element A_N, as well as the additional code A₃. The A_N number is a consecutive number which is used to number identical equipment, which is identified by A₁, A₂, within the same system. Grouping is done according to A_N Numbering (4.2.3.1).

The following coding letters and designations of the main groups A₁ are applicable for coal, hydro and gas power plants as given in the Equipment Unit Key in the Key Part:

- A** Mechanical equipment (machinery including driven or hand operated).
- B** Mechanical equipment (plant)
- C** Direct measuring circuit
- D** Closed-loop control circuit
- E** Analog and binary signal conditioning
- F** Indirect measuring circuit
- G** Electrical equipment
- H** Sub-assembly of main and heavy machine

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Classification for A_2 and the associated designations are given in the KKS Key Part (Equipment Unit Key). The path for looking up items in the Equipment Unit Key is governed by the same rules as that for the Function Key. A_1 and A_2 shall be coded as per Key Part and no deviations shall be accepted. The VGB Technical Committee on Technical Classification Systems may reserve unused A_1 and A_2 data characters.

4.2.3.1 A_N Numbering

A_N - Numbering of mechanical equipment, electrical and control and instrumentation equipment.

Code A_N numbering shall follow specific counting rules for particular equipment type groups, with increment in ones.

Counting rules for code A_N as they appear in the KKS Key Part:

This shall be applicable to all KKS Power Stations with the exception of Ankerlig OCGT. Refer to Appendix B for A_N counting rules applicable to Ankerlig OCGT.

When coding different types of valves, dampers including actuators, rupture discs, etc., coding and numbering for A_N , when data character $A_1A_2=AA$, shall be as follows:

001-099	Analogue operated control valve
101-199	Binary operated valve with electrical actuator
201-299	Binary operated valve with pneumatic, hydraulic or solenoid actuator
301-399	First isolating valve for measuring devices at the tapping point
401-499	Drain and vent valve
501-599	Hand operated valve (except the valve referred to 301-399 and 401-499)
601-699	Mechanically operated valve (except the valve referred to 301-399 and 401-499)
901-999	Safety valves

Coding and numbering of A_N for direct measuring circuits such as pressure, level, position, etc., is as follows, when data character $A_1A_2=C^*$, (* denotes all direct measuring circuits as per KKS Key Part except CE):

001-099	Analogue remote measurement
301-399	Binary remote measurement
401-499	Test and adjustment measuring point
501-599	Local measurement
601-699	Temporary measuring circuit
901-999	Combined measuring circuit

Coding and numbering of A_N for electrical measurement and when data character $A_1A_2=CE$, shall be as follows:

101-199	Voltage measurement
201-299	Current measurement
301-399	Frequency measurement
401-499	Megawatt
501-599	Megavolt ampere reactive

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601-699	Kilowatt hour
701-799	Kilovolt ampere reactive hour
801-899	Power factor

Coding and numbering of A_N for electrical measurement and when data character $A_1A_2=GS$, shall be as follows:

101-199	Breakers
201-299	Isolators
601-699	Earth Switches

Code Position A_3 shall be used for coding pilot valves, multiple drives or measuring circuits sharing a common sensor. It further subdivides the A_N identification code and denote additional information as per the VGB guidelines. If not used, this position shall remain blank.

Example 3: Identification of an equipment unit (pump unit)

Serial number of BDL	0	1			2			3	
Title of BDL	Total Plant	System			Equipment Unit			Unit component	
Example	Common Plant	Spray system			Pump unit			Pump	
Data character	G	F_0	$F_1F_2F_3$	F_N	A_1A_2	A_N	A_3	B_1B_2	B_N
KKS Code	=0	0	SGC	10	AP	001			

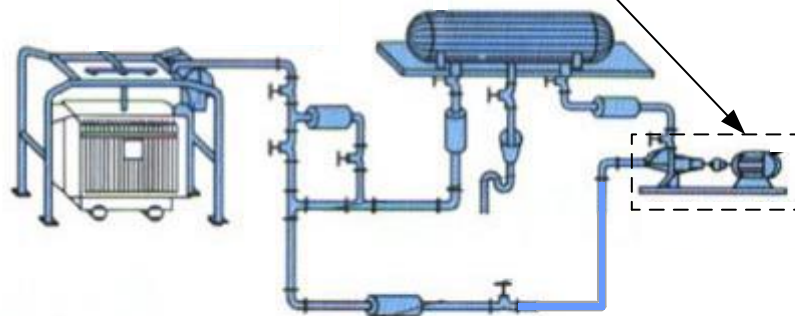


Figure 17: Pump unit identification

Example 4: Identification of coal conveyor system coupled with multiple drives and motors

Serial number of BDL	0	1			2			3	
Title of BDL	Total Plant	System			Equipment Unit			Unit component	
Data character	G	F ₀	F ₁ F ₂ F ₃	F _N	A ₁ A ₂	A _N	A ₃		
KKS Code	=0	0	ECB	11	AF	001	A		
		Conveyor system			First drive				
					AF	001	B		
					Second drive				

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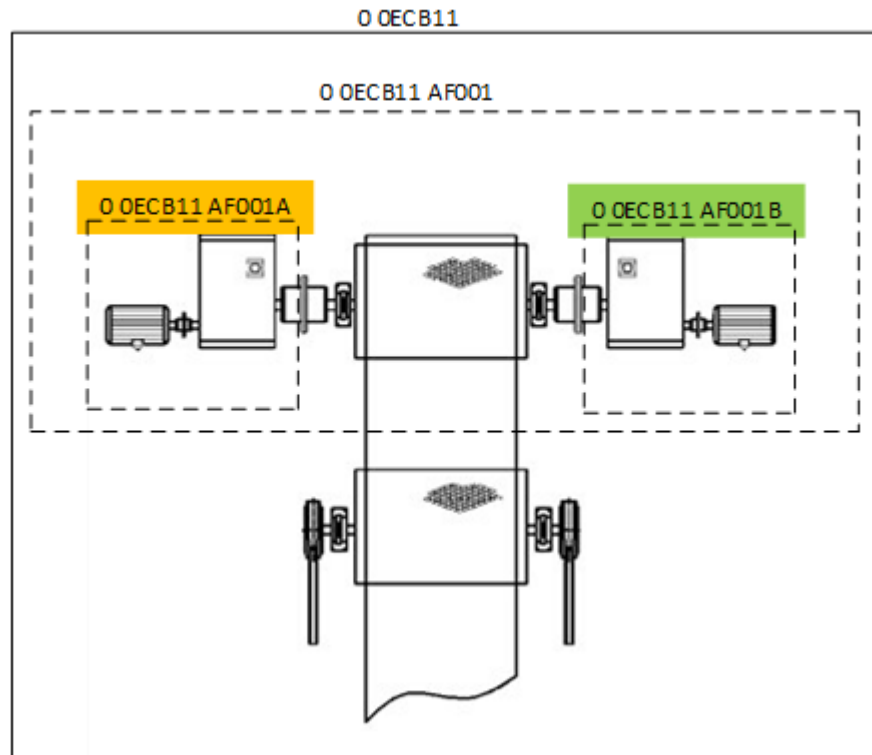


Figure 18: Coal conveyor system identification

4.2.4 Break Down Level 3 (Component code)

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	System code			Equipment code			Component code	
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 key	N	N	AAA	NN	AA	NNN	A	AA	NN

The component code subdivides equipment units into separate components, signals or signal applications. The component code consists of component classification B₁, B₂ and numbering element B_N.

The following coding letters and designations of the main groups B₁ applicable for coal, hydro and gas power plants are given in the component key in the Key Part:

- Electrical component
- K** Mechanical unit components (production)
- M** Mechanical unit components (auxiliary)
- Q** Instrumentation and control component (non-electrical)
- X** Signal origin
- Y** Signal application
- Z** Gated signal

The associated designations for subgroup B₂ are given in the applicable Key Part (Component Key). B₁ and B₂ shall be coded as per Key Part.

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Example 5: Identification of a unit component (pump)

Serial number of BDL	0	1			2			3	
Title of BDL	Total Plant	System			Equipment Unit			Unit component	
Example	Common Plant	Spray system			Pump unit			Pump	
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
KKS Code	=0	0	SGC	10	AP	001		KP	01

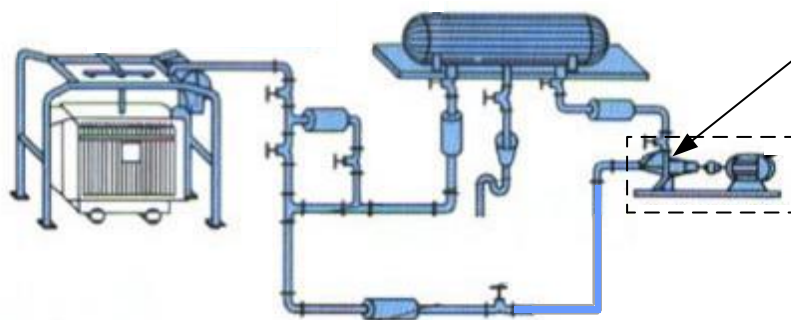


Figure 19: Pump unit component identification

Example 6: Potable water pump system and a subdivision

Serial number of BDL	0	1			2			3	
Title of BDL	Total Plant	System			Equipment Unit			Unit component	
Example	Common Plant	Spray system			Pump unit			Pump	
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
KKS Code	0	0	GKC	10	AP	010		-M	01
		Potable water pump system			Pump unit			Motor	
								MK	01
								Coupling	
								KP	01
								Pump	

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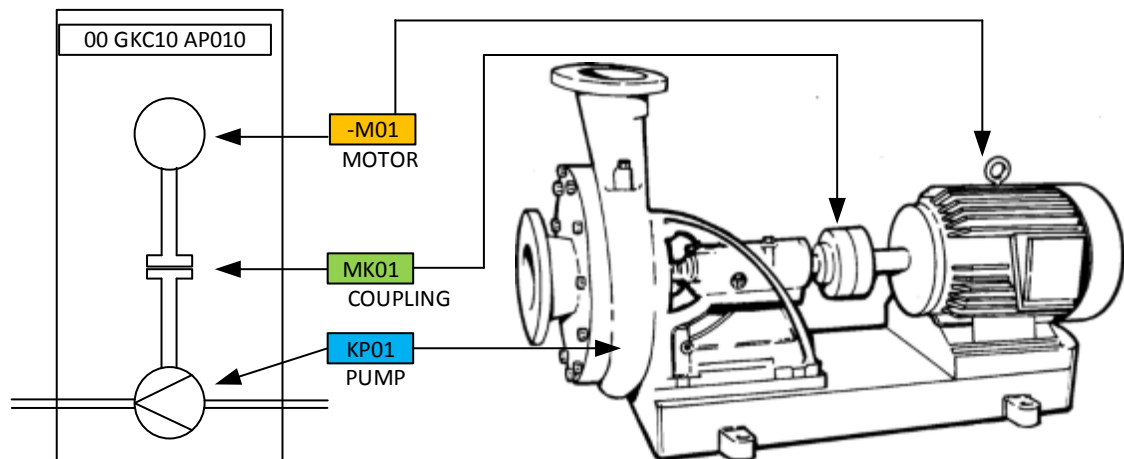


Figure 20: Pump system identification

5. POINT OF INSTALLATION IDENTIFICATION

This shall be used for identification of points of installation for electrical and control and instrumentation devices in installation units (e.g. in cabinets, panels, consoles).

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	Installation unit code			Installation space code			Component code	
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 key	N	N	AAA	NN	AA	NNN	A	AA	NN

5.1 BREAK DOWN LEVEL 0 (TOTAL PLANT)

Code position G shall be used to define a common plant or a unit number where:

G = 0 for a common plant,

G = N for unitised plants

Total plant numbering shall apply to all Eskom KKS Coded power plants.

5.2 BREAK DOWN LEVEL 1 (INSTALLATION UNIT CODE)

F₀ supplements classifying information for installation units referred to in (F₁ - F₃). It shall only be used if there are more than one identical installation units identified in the subsequent alpha characters which shall be coded separately, otherwise it shall be coded as 0 (zero).

The alpha characters (F₁-F₃) classify subdivision of installation units e.g. cubicles, consoles, cabinets, panels. It shall be coded as per KKS Key Part.

Coding letters and designations of the main groups F₁ from the Function Key:

- A** Grid and distribution system
- B** Power transmission and auxiliary power supply
- C** Instrumentation and control equipment

Special engineering discipline-specific rules apply to installation unit classification in connection with other F₁ main groups.

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The classifying part of the point of installation code serves to identify hardware facilities such as switchgear, electronic equipment cabinets and control consoles. The coding letters A, B, C of the main group F_1 are identical for both process-related and point of installation identification. Allocation of the many unreserved F_2 and F_3 data characters is governed by the individual plant concept, i.e. by aspects such as auxiliary power system configuration, hardwired control and instrumentation in conventional technology or combined cabinets or programmable logic systems. Generally valid rules cannot be established.

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

F_N shall number subdivisions of installation units. Its numbering starts anew when the preceding code numbering changes.

5.3 BREAK DOWN LEVEL 2 (INSTALLATION SPACE CODE)

Code position A_1 and A_2 shall denote the vertical subdivision rows of installation locations in installation units.

Code position A_N denotes the horizontal subdivision rows of installation locations in installation units.

Code position A_3 is an additional code designated for special installation of components or further subdivision of A_N .

Example 7: Point of installation identification

Serial number of BDL	0	1			2		
Title of BDL	Total Plant	Installation unit code			Installation space code		
Example	Unit 1	Low-voltage distribution board			Installation space		
Data character	G	F_0	$F_1 F_2 F_3$	F_N	$A_1 A_2$	A_N	A_3
KKS Code	+1	0	BFA	03	CA	001	

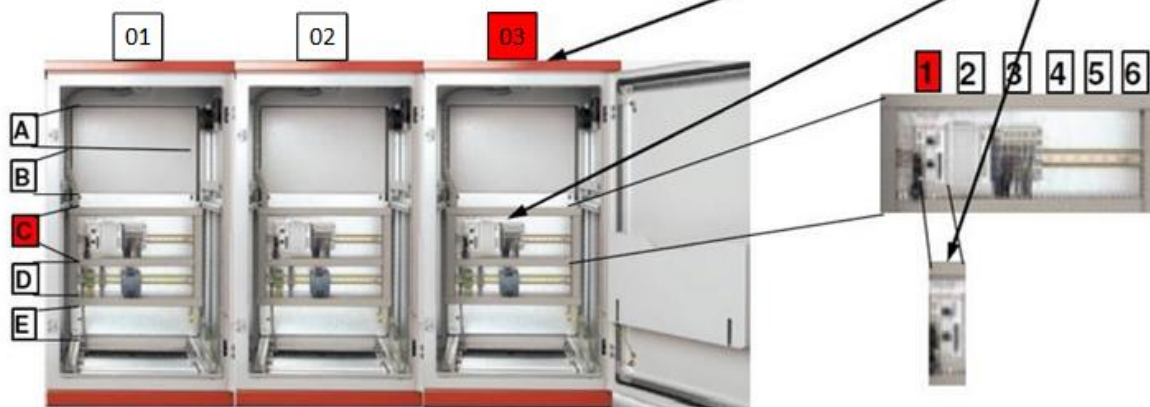


Figure 21: Point of installation identification

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5.4 BREAK DOWN LEVEL 3 (COMPONENT CODE)

Serial number of BDL	0	1			2			3	
Title of BDL	Total plant	Installation unit code			Installation space code			Component code	
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 key	N	N	AAA	NN	AA	NNN	A	AA	NN

The component code consists of component classification B₁, B₂ and numbering element B_N.

Code position shall classify components, signals or signal applications.

Coding letters and designation of main group B₁ for components are given in the component key and for signals and signal applications.

The following coding letters and designations of the main groups B₁ are applicable for coal, hydro and gas power plants as given in the component key and for signals and signal applications:

- Electrical component
- K** Mechanical unit components (production)
- M** Mechanical unit components (auxiliary)
- Q** Instrumentation and control component (non-electrical)
- X** Signal origin
- Y** Signal application
- Z** Gated signal

The associated designations for subgroup B₂ are given in the applicable Key Part (Component Key). B₁ and B₂ shall be coded as per Key Part.

Code position B_N shall be used to number components, signals or signal applications.

6. IDENTIFICATION OF LOCATION

The location code identifies structures, floors, rooms and fire areas in order to provide unique addressing of physical location, section and items of equipment in power plants. Location identification applies to all engineering discipline including civil, mechanical, electrical, control and instrumentation engineering.

Serial number of BDL	0	1			2		
Title of BDL	Total plant	Structure code			Room code		
Data character	G	F ₀	F ₁ F ₂ F ₃	F _N	A ₁ A ₂	A _N	A ₃
Type of key	N	N	AAA	NN	AA	NNN	A

6.1 BREAK DOWN LEVEL 0 (TOTAL PLANT)

Code position G shall be used to define a common plant or a unit number where:

G = 0 for a common plant,

G = N for unitised plants

Total plant numbering shall apply to all KKS Coded power plants.

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6.2 BREAK DOWN LEVEL 1 (STRUCTURE CODE)

Code position F_0 shall number similar structures within the parts of the plant identified in level 0.

Code positions F_1 F_2 F_3 shall classify the subdivisions of structure according to the Function Key specified by the KKS Key Part. Coding letters and designation for the main group F_1 from the Function Key is as follows:

U Structure

The subdivisions in F_2 and F_3 shall be taken from each applicable Function Key.

The coding letters used in F_2 are largely identical to those of the main group F_1 of the KKS for example;

$F_1 = G$ Water supply disposal

Associated structures for water supply and disposal

$F_1 F_2 = UG$ Structures for water supply and disposal

Consequently groups of structures are established in F_2 on the basis of the process features. The following are the coding letters and designations of groups $F_1 F_2$ given in the Function Key:

Table 4: Applicable function Keys and the designated groups

F_0	F_1	F_2	F_3	F_N	Text
-	U	A	-	-	Structures for grid and distribution systems
-	U	B	-	-	Structures for power transmission and auxiliary power supply
-	U	C	-	-	Structures for instrumentation and control
-	U	E	-	-	Structures for conventional fuel supply and residues
-	U	G	-	-	Structures for water supply and disposal
-	U	H	-	-	Structures for conventional heat generation
-	U	L	-	-	Structures for steam-, water-, gas-cycles
-	U	M	-	-	Structures for main machine sets
-	U	N	-	-	Structures for process energy supply
-	U	P	-	-	Structures for circulating (cooling) water systems
-	U	S	-	-	Structures for ancillary systems
-	U	T	-	-	Structures for auxiliary systems -
-	U	V	-	-	Structures for chemical flue gas treatment incl. residue removal
-	U	X	-	-	Structures for external systems (power plant specific)
-	U	Y	-	-	General service structures
-	U	Z	-	-	Structures for transport, traffic, fencing, gardens and other purposes

The code position F_N shall be used in numbering subdivision of structures into floors, storey, platforms, elevators etc. Numbering direction shall be from the floor at the lowest level upwards and it shall start anew for each structure.

Classification of structures in coal and gas power plants is represented in Figure 22 and Figure 23 according to the applicable function keys in Table 4.

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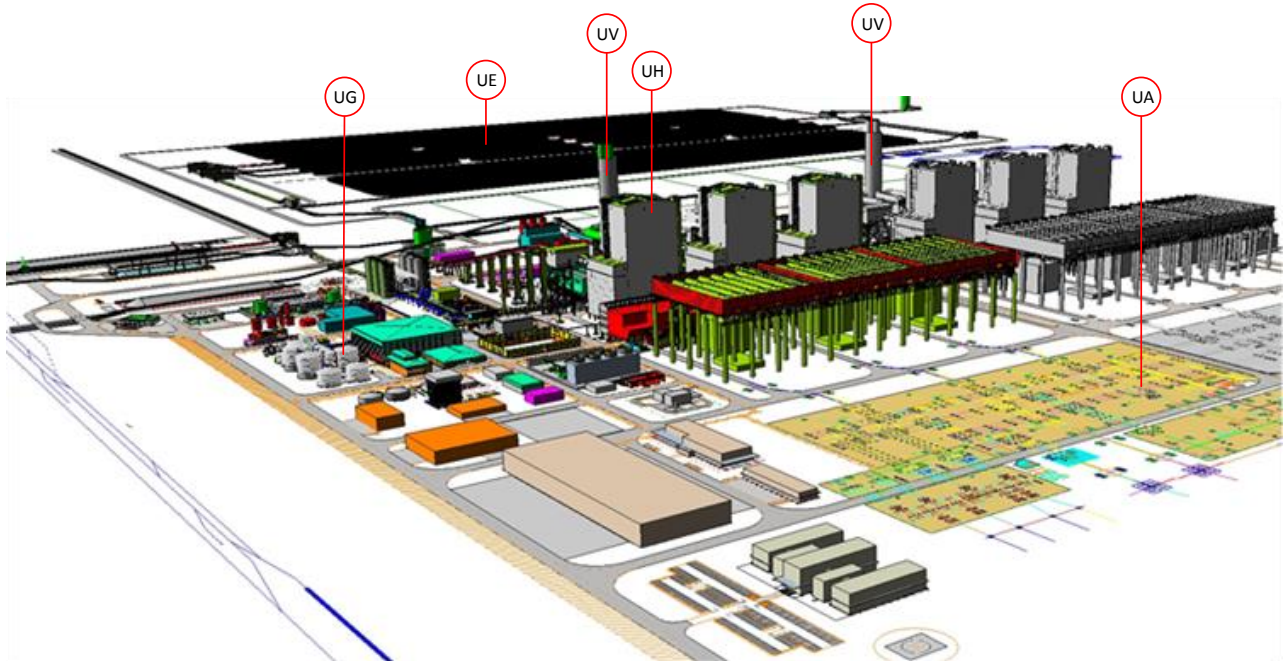


Figure 22: Structures Classification in Coal Power Plant



Figure 23: Structures Classification in Gas Power Plant

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6.3 BREAK DOWN LEVEL 2 (ROOM CODE)

Room code shall identify physically separated and logically defined rooms/areas in structures and in open areas.

Physically separated rooms in structures shall be identified by numbering the rooms. Logically defined rooms/areas in open areas shall be identified by numbering of Field Raster or grid squares.

6.3.1 Identification by numbering

Code position A_1 shall identify rooms and fire areas. The identification letters and designations for the main group A_1 are:

R Room

S Fire area (must always be written)

Code position A_2 shall be "M".

Code position A_N shall be used in numbering rooms and fire areas in each floor. Numbering of A_N shall start from 001 with increment in unit numbers.

Code position A_3 shall be used to denote additional code for subdivision of room number.

6.3.2 Identification by Field Raster (Grid square)

Serial Number of BDL	0	1			2				
Definition	Total Plant	Structure Code			Room-code				
Data character	G	F ₀	F ₁ F ₂ F ₃	F _N	A ₁	A ₂	A _N		A ₃
KKS	N	N	AAA	NN	A	A	N	NN	A

Classification of Room

Data character $A_1=R$ shall be included always

Field raster on high value (alphanumeric)

The numeric data character can be omitted

Field raster on easting (numeric)

Additional code (for subdivision of grid)

7. CODING RULES FOR CABLES

All cables in the plant shall be numbered according to the VGB standard of numbering cables.

Eskom shall use process-related or point of installation code in part for classifying element.

They shall be numbered sequentially from a common database to avoid duplication.

7.1 CABLE NUMBER COUNTING RULES

Breakdown Level 1 code identifies either the origin/source or the destination from which the cable is laid, followed by a four-digit counting number. The four numerals represent consecutive cable numbers depending on the voltage level for grouping purposes within the cable number as shown in Appendix A. The first digit of the four numeric data characters identifies the application area, the other three number cables within that area. Breakdown Level 1 code shall be assigned the KKS Code of either the cable

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source or destination which is first in alphabetical order (e.g. if system **1 0MFX 10** is connected to the system **1 0CXA10** then **1 0CXA NNNN** is the cable number).

To ensure that cable numbers are not duplicated, an optional classification is added. This consists of four alpha characters, first two (BB) identifying the F_1 and F_2 functions of the source or destination of the cable, and the second two (CC) identifying the contractor responsible for the design of the cable.

Cable Number structure.

Serial Number of BDL	0	1	2				3	
BDL title	Group	Location	Cable number				Additional classification	
Type of character	(A/N)	NAAA	N	N	N	N	AA	AA
Example	1	0CXA	4	0	0	1	BB	CC

Cable from cubicle related to Unit 1: 1 0CXA

Cable number: 4001

Additional classification: BB CC

Whole cable number: **10CXA 4001 BBCC**

7.2 CABLE RACK NUMBERING

Cable racks are identified according to their location, voltage level, function and type of rack.

BDL 1 of the identification code shall represent the location code of the rack while F_N codes shall classify the cable racks according to the voltage level and function of the cables installed as shown in Table 5:

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Table 5: Cable rack identification

Serial No. of breakdown level	1	
Identification of data character	FN	Voltage level/function
	10	Control and instrumentation cable $\leq 60V$ AC or DC
	11	Optic fibre cables
	12	Fire detection cables
	20	LV control and power cable ($> 60V$ and $\leq 1kV$ AC or DC)
	21	LV small power and lighting cable from distribution boards to equipment ($> 60V$ and $\leq 1kV$ AC or DC)
	30	3.3kV MV power cable
	31	18kV MV power cable
	40	400kV HV cable
	50	Specialised segregated racks

For racks containing mixed voltages, the cable voltage rack allocation for F_N shall follow the highest voltage.

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8. AUTHORISATION

This document has been seen and accepted by:-

Name & Surname	Designation
Louis Fernandez	Senior Manager, Data and Information Management
Dr. Riekie Swanepoel	Chief Technologist
Nomfundo Mtshali	Arnot D&S Manager
Rudi Sono	Camden D&S Manager
Oloff Nel	Duvha D&S Manager
Mpho Sekonyela	Grootvlei D&S Manager
Anari van Greuning	Hendrina D&S Manager
Pieter Schimper	Kriel D&S Manager
Godfrey Mthombene	Komati D&S Manager
Nathi Mazibuko	Lethabo D&S Manager
Anthony Mashabane	Majuba D&S Manager
Mpho Rikhotso	Matimba D&S Manager
Ettienne Van Zyl	Matla D&S Manager
Mehendra Maharaj	Middle Manager, Maintenance
Leonard Mathebula	Senior Technician, Draughting
Abdul Gire	Peaking D&S Manager
Chuma Mketo	Plant Configuration Management Manager
Siyasanga Dayile	Senior CM Configuration Technician
Solly Masina	Plant Configuration Management Manager
John Bartlett	CM Coding Specialist
Jabulane Mathebula	Senior CM Coding Technician
Renier Smal	CM Coding Specialist
Xolani Gumede	CM Coding Technician
Ndabanhle Nxumalo	CM Coding Technician
Mboniseni Sangweni	CM Coding Technician
Nicholas Maluleke	CM Coding Technician
Benny Lesejane	Senior CM Configuration Technician
Nomvuyo Luthuli	CM Configuration Technician
Nkululeko Jama	CM Configuration Technician

9. REVISIONS

Date	Rev.	Compiler	Remarks
May 2016	0.1	J. Mathebula	Developed first draft
May 2016	0.2	J. Mathebula	Draft Document for Comments Review
June 2016	0.3	J. Mathebula	Updated comments by the Compiler
July 2016	0.4	J. Mathebula	Jabulane requested document for changes
July 2016	1	J. Mathebula	Final Document for Authorisation and Publication
June 2017	1.1	J. Mathebula	Updated to remove old References

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Date	Rev.	Compiler	Remarks
June 2017	2	J. Mathebula	Final Rev 2 Document for Authorisation and Publication
June 2018	2.1	L. Koech	Updated Cable Numbering, Applicability and F _N Consecutive and Decadic Numbering (Paragraph 4.2.2).
July 2018	2.2	L. Koech	Updated Comments from Internal Review
06 th July 2018	2.3	L. Koech	Final Draft Document for Comments Review Process
27 th July 2018	2.4	L. Koech	Final Draft for Approval and Authorisation after review
June 2020	3	J. Mathebula	Final Rev 3 Document for Authorisation and Publication

10. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- T. Banda
- L. Koech
- T. Tshabalala
- R. Smal
- J. Bartlett
- J. Mathebula
- P. Macnamara

11. ACKNOWLEDGEMENTS

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APPENDIX A: CABLE NUMBERING

Breakdown Level 2 of cable identification structure is 4 numerals which represent the consecutive cable number depending on the voltage level for grouping purposes within the cable number.

Cable numbering as shown in Table 6 is applicable to **Arnot, Duvha, Hendrina, Kriel, Lethabo, Majuba, Matimba, Matla and Tutuka** Power Stations

Table 6: Cable Numbering

NNNN	Application	Example
0001 to 0999	AC power cables > 1kV	400kV
1001 to 1999	AC power cables ≤ 1kV	230/400V AC
2001 to 2499	DC power cable 110V or 220V DC	110V or 220V DC (power cable)
2501 to 3999	Control cable > 60V DC	110V or 220V DC control cable
4001 to 4499	Control cable ≤ 60V DC fire fighting	
4501 to 5999	Control cable ≤ 60V DC	24V DC control cable
6001 to 6499	Measuring cable current transformer	
6501 to 6999	Measuring cables voltage transformer	
7001 to 7999	Measuring cables	Pt 100, vibration, ultra-sensor
8001 to 8999	Communication cables	48V DC
9001 to 9999	Special cables	Fibre optic, coax

Cable numbering stated in Table 7 below are applicable to **Camden, Grootvlei, Kendal, Komati, Medupi, Kusile** and **CSP Upington** Power Stations only.

Table 7: Exceptions in Cable Numbering

NNNN	Application
0001 – 0999	Power Cables >1kV
1001 – 1999	Power Cables ≤ 1kV
2001 – 3999	Control Cables >60V
4001 – 9999	Control Cables ≤ 60V

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APPENDIX B: A_N NUMBERING RULES APPLICABLE TO ANKERLIG OCGT

Number Range (NNN)	Valves (AA..)	Pipes (BR..)	Measuring Circuits (C..)
001 – 050	Valves in main pipes	Main Pipes	001 – 080: analog measurement 080 – 100: binary measurement
051 – 100	Motor operated valves		
101 – 150	Actuated valves		
151 – 190	Control valves		
191 – 199	Safety valves	Suction and pressure relief lines on safety valves	
201 – 250	Check valves	Not used	For testing equipment
251 – 299	Not used		
301 – 399	Isolating equipment for measuring	Pressure lines for measurement	Not used
401 – 499	Valves in drains and flushing pipes	Drains, flushing pipes, pressure suppression pipes	Acceptance test
501 – 599	Valves for venting	Venting	Local measuring circuits
601 – 699	Valves for sampling and proportioning	Sampling and proportioning pipes	Not used
701 – 799	Valves for internal controls	Internal control pipes	Blocked
801 – 899	Not used	Not used	Blocked
901 – 999	Not used	Not used	Grouped measuring circuits (e.g. Multipoint selector switches, multi-channel recorders)

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