PCIC EUROPE
PETROLEUM & CHEMICAL INDUSTRY COMMITTEE

EUR18_18 - PAS IEC 63131 System Control Diagram Tutorial

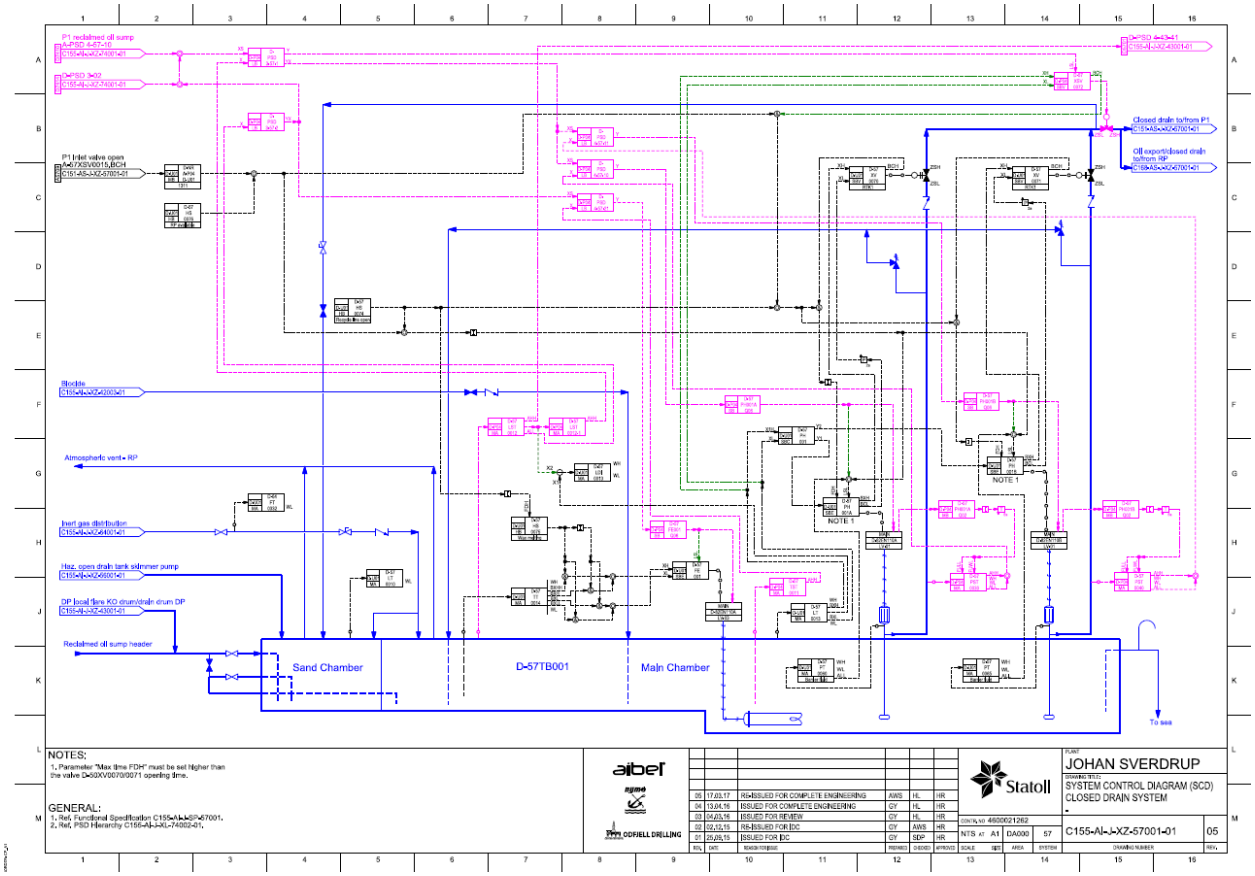
Idar Pe Ingebrigtsen, Equinor

Agenda

- Introduction
- Background for the method
- The extend of usage so far
- The Standard
  - The Function blocks
  - The Diagram
  - The Method

Introduction

- The system control diagram is a logic diagram which starts where the P&ID ends.
- It uses the process as background.



Background

- The challange - to create the ICSS application for an offshore oil and gas platform on the Continental Norwegian Shelf.
- Some of the Framework
  - An offshore oil and gas platform covers 40 wells giving 200.000 barells of oil each day , produces it's own power, water, heat and may have a LQ with 200 beds.
  - The process medium is higly flamable and explosive, hence process safety is vital.
  - Process safety systems are integrated with process control on the operator station. Focus on no commen failure mode. Process safety actions is automatic and independant of process control in the application on controller level.
  - Process safety and Process control application to be developed in a systematic manner.
  - F&G system , Emergency shutdown, Process shutdown and process control.

Background -The history of logic diagrams - Statoil

- During 80thies use of Logic diagrams , elementary function blocks
- Norsk Hydro did Oseberg field development 1985 – 1989 and the nee
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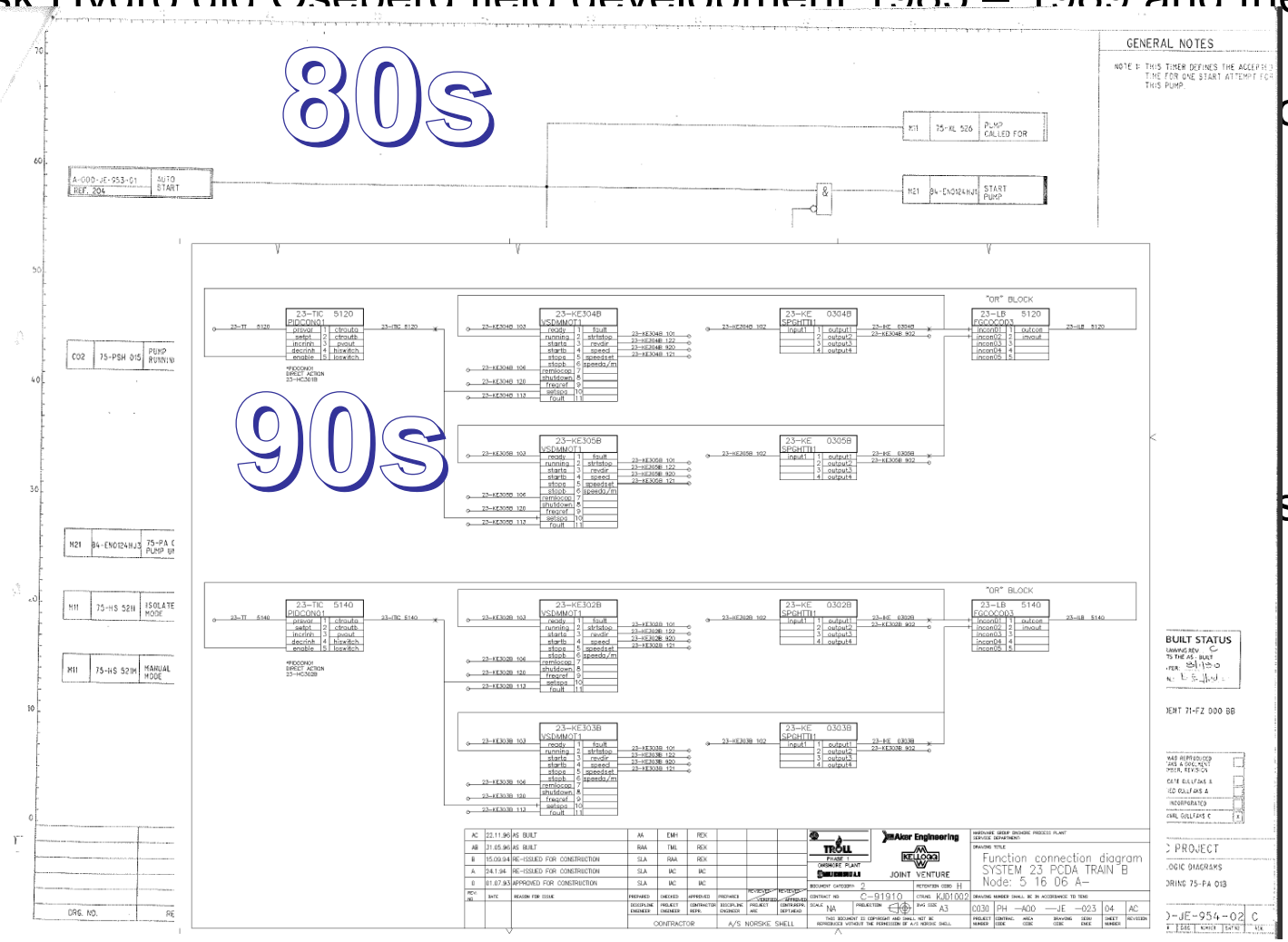


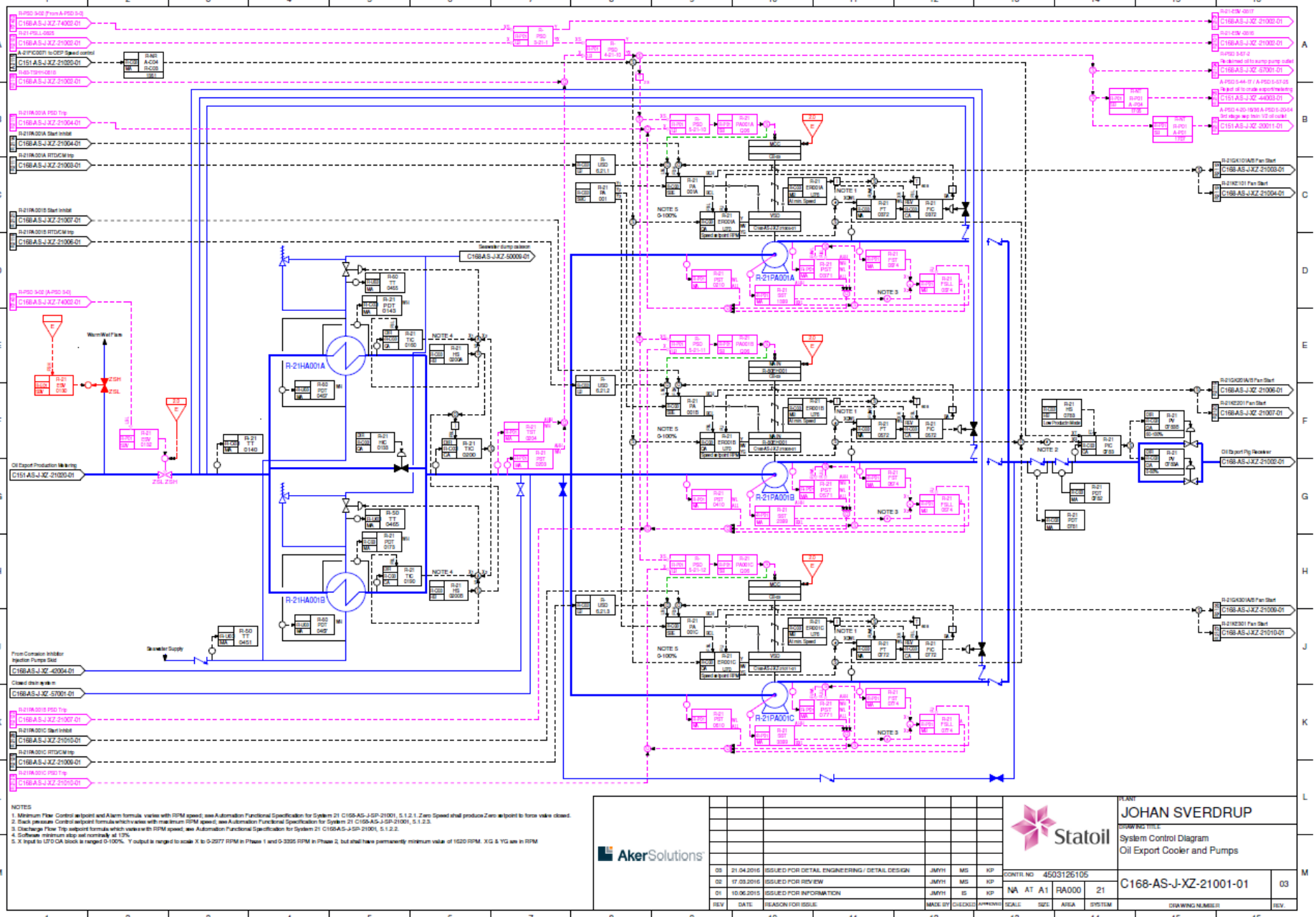
Usage - SCD referance list the first 10 years.

Project	Year	Operator	Supplier	Eng. Contr.
Brage	1994	Norsk Hydro	Siemens	Kværner
Troll B	1995	Norsk Hydro	Honeywell	Aker
Heidrun	1995	Conoco/Statoil	Simrad	Kværner
Sleipner Vest	1996	Statoil	ABB	Kværner
Njord	1997	Norsk Hydro	Siemens	Aker
Norne	1997	Statoil	Simrad	Kværner
Ekofisk	1998	Phillips	ABB	Kværner
Troll C	1998	Norsk Hydro	Siemens	Umoe
Jotun	1999	Esso	Honeywell	Kværner
Visund	1999	Norsk Hydro	Siemens	Umoe
Oseberg Øst	1999	Norsk Hydro	Siemens	Kværner
Oseberg Sør	2000	Norsk Hydro	Siemens	Aker
Oseberg Gass	2000	Norsk Hydro	Siemens	Aker
Snorre B	2001	Norsk Hydro	Siemens	Kværner
Kvitebjørn	2003	Statoil	Honeywell	ABB
Grane	2003	Norsk Hydro	ABB	Kværner

Usage - SCD Usage recent projects

Project	Year	SAS	Eng.Contr. /SCD	Operatør	Proj type
Gudrun	2014	ABB	Aibel	Statoil	Greenfield
Eldfisk	2015	Siemens	Aker Solutions	ConocoPhillips	Brownfield Greenfield
Tyrihans	2009	Kongsberg	FMC	Statoil	Tie-in Kristin
Morvin	2010	Kongsberg	AK subsea	Statoil	Tie-in Åsgard B
O2		Siemens	Siemens	Statoil	Tie-in
Kårstø NGL Meetering		ABB	MWKellog	Statoil	Upgrade
Valomon	2016	Honeywell	Samsung/ Technip KL	Statoil	Greenfield
Goliat	2017	ABB	Hyundai/ABB	ENI	Greenfield
Ekofisk Z	2013	ABB	Aker Solutions	ConocoPhillips	Greenfield
Jordbær		ABB	Samsung/ABB	TeeKay	Greenfield
Mariner	2018	Kongsberg	DSME / CB&I London	Statoil	Greenfield
Aasta Hansteen	2017	ABB	Hyundai / CB&I Haag	Statoil	Greenfield
Gina Krogh	2017	Emerson	Daewoo / Akersol. KL	Statoil	Greenfield
Edvard Grieg	2016	Honeywell	Akersolutions	Lundin	Greenfield
Johan Sverdrup	2019	Kongsberg	AkerSolutions / Aibel / KBR	Statoil	Greenfield

Usage - within Statoil

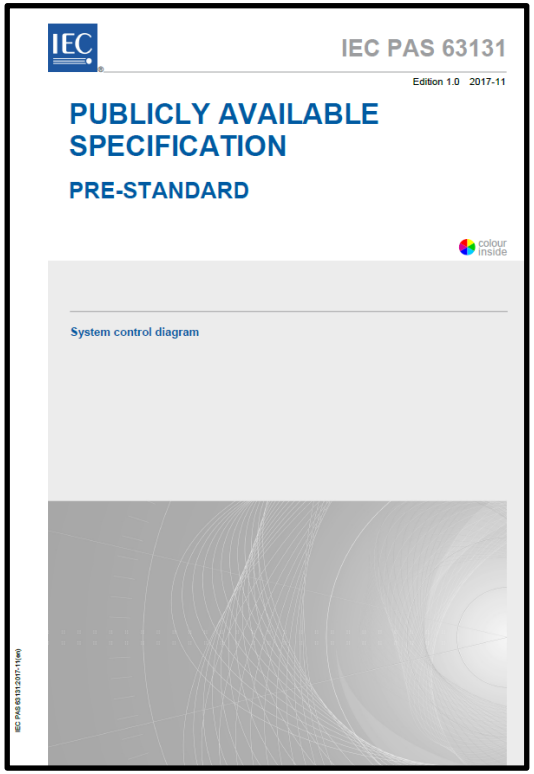

R-21HA001A
R-21HA001B
R-21PA001A
R-21PA001B
R-21PA001C
NOTES
1. Minimum Flow Control setpoint and Alarm formula varies with RPM speed; see Automation Functional Specification for System 21 C168-AS-J-SP-21001, 5.1.2.1. Zero Speed shall produce Zero setpoint to force valve closed.
2. Back pressure Control setpoint formula which varies with maximum RPM speed; see Automation Functional Specification for System 21 C168-AS-J-SP-21001, 5.1.2.3.
3. Discharge Flow Trip setpoint formula which varies with RPM speed; see Automation Functional Specification for System 21 C168-AS-J-SP-21001, 5.1.2.2.
4. Software minimum stop set nominally at 13%.
5. X Input to LF0 CIA block is ranged 0-100%. Y output is ranged to scale X to 0-2977 RPM in Phase 1 and 0-3395 RPM in Phase 2, but shall have permanently minimum value of 1620 RPM. XG & YG are in RPM
AkerSolutions
Statoil
PLANT
JOHAN SVERDRUP
DRAWING TITLE
System Control Diagram
Oil Export Cooler and Pumps
05 21.04.2016 ISSUED FOR DETAIL ENGINEERING / DETAIL DESIGN JMYH MS KP
02 17.03.2016 ISSUED FOR REVIEW JMYH MS KP
01 10.06.2015 ISSUED FOR INFORMATION JMYH IS KP
REV DATE REASON FOR ISSUE MADE BY CHECKED APPROVED
CONTR. NO 4503126105
NA AT A1 PA000 21
SCALE SIZE AREA SYSTEM
C168-AS-J-XZ-21001-01 03
DRAWING NUMBER REV.

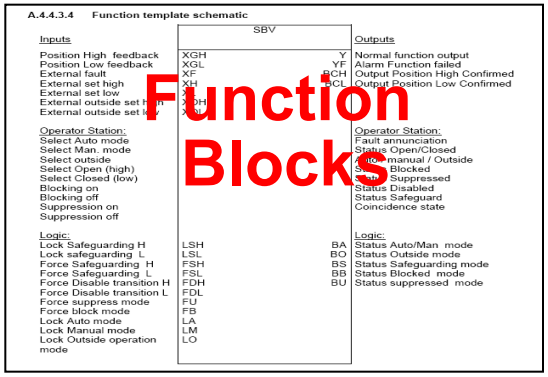
The standard - What is the SCD concept

- Function blocks on a functional and operational high level
  - Tagnumbers on SCD corresponds to the object names on the operator station objects. Identifies ’the point of access’ for operators.
- Control logic presented on a process-diagram, including the safety interlocks
  - Easy access to interlock logic during trouble shooting
- Focus on the control logic’s mulidisplin stakeholder input
  - Secure best possible quality of functionality during design phase

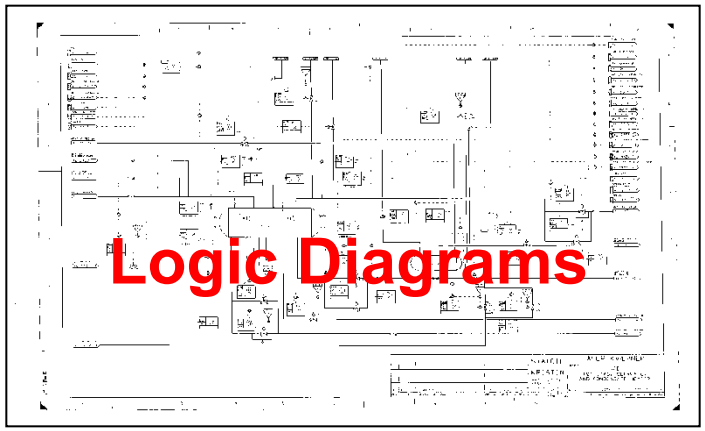
System Control Diagram - SCD - PAS IEC 63131

- A method of designing control system logic.
- Consist of 2 parts





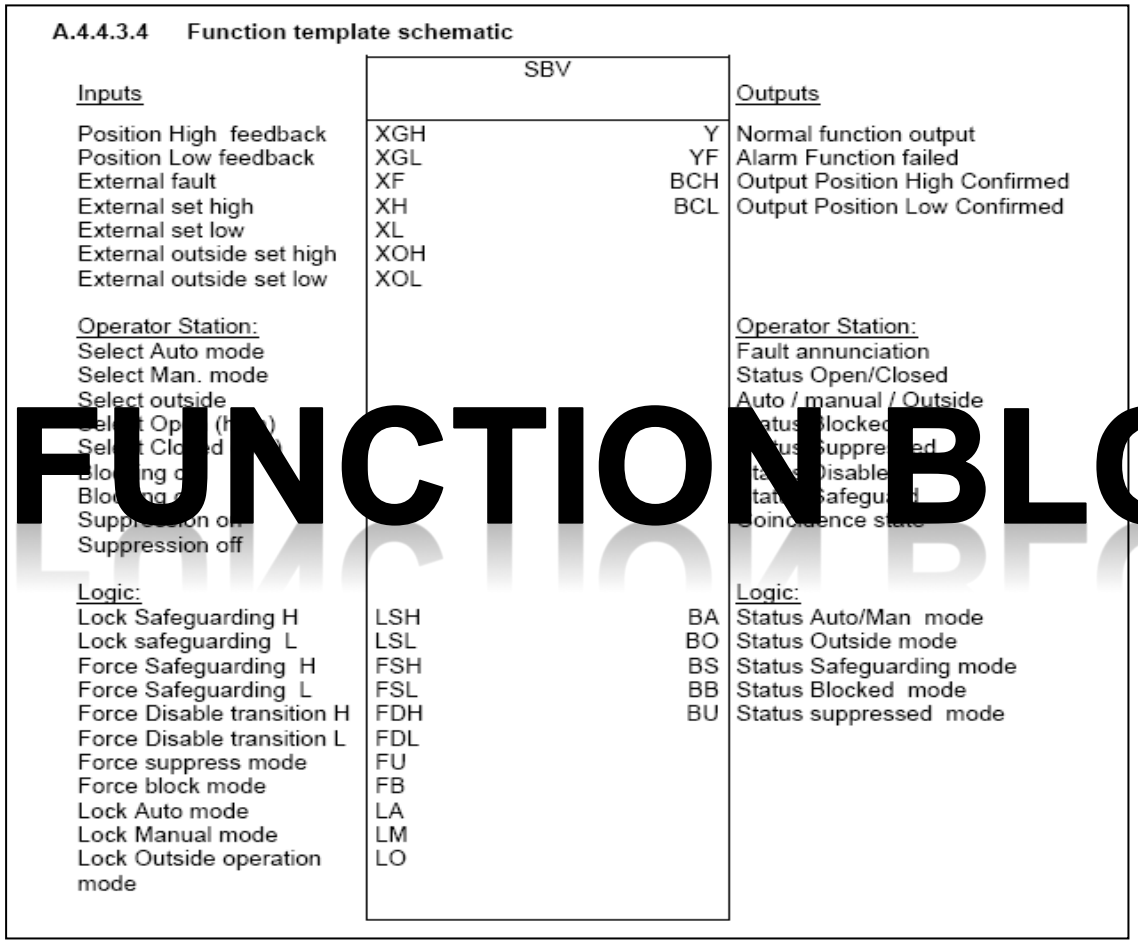
Function Blocks



Logic Diagrams

THE FUNCTION BLOCKS

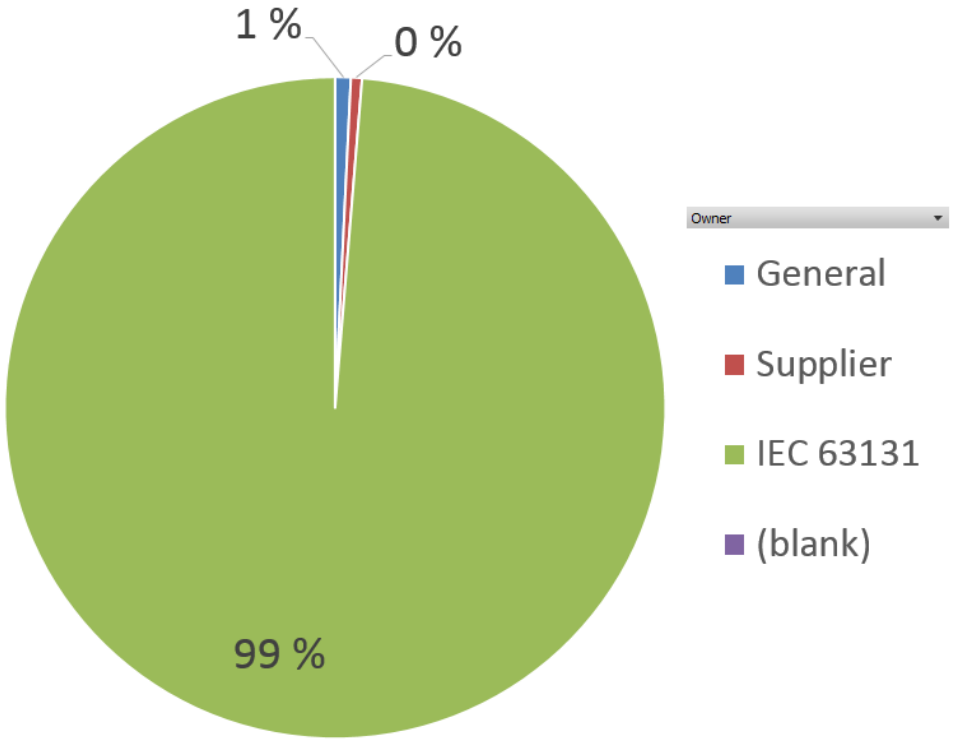
A.4.4.3.4 Function template schematic

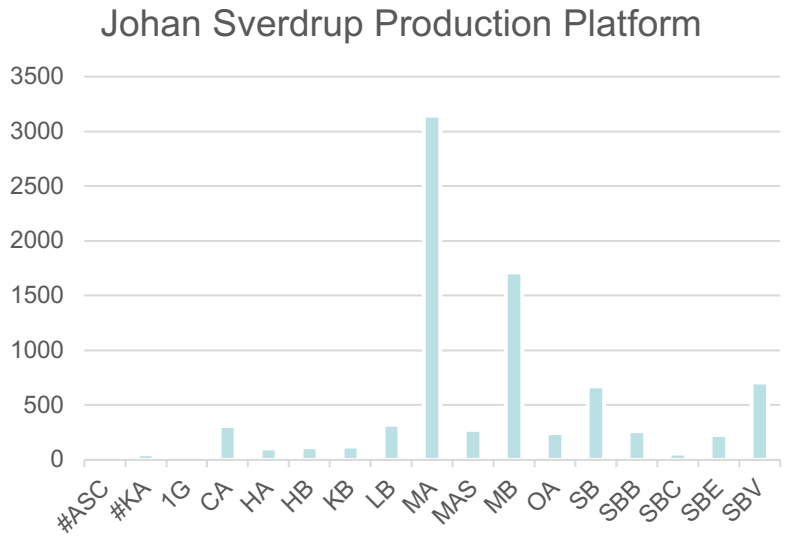


Function Template – 16 pcs

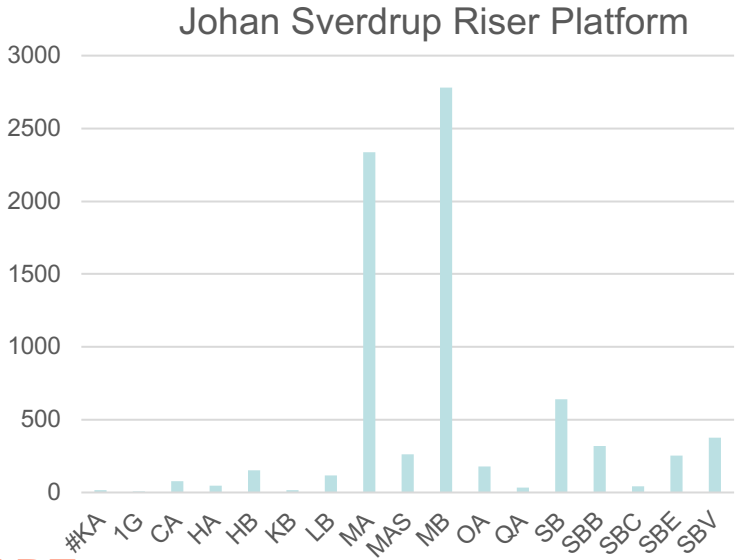
- **CA** – PID controller (Continuous Analog)
- **CS** – Step control (Continuous Step)
- **HA** – Manual analog input (Hand Analog)
- **HB** – Manual binary input (Hand Binary)
- **KB** – Sequence header (Sequencing Binary)
- **LB** – Shutdown level (Latching Binary)
- **MA** – Analog measurement (Monitoring Analog)
- **MAS** – Analog measurement from subsystem (Monitoring Analog Serial)
- **MB** – Digital input (Monitoring Binary)
- **OA** – Analog output (Output Analog)
- **QA** – Totalizer (Totalize Analog)
- **SB** – Digital output (Switching control Binary)
- **SBB** – El. breaker operation (Switching Binary Breaker)
- **SBC** – Coordination of multiple SBE (Switching Binary Coordination)
- **SBE** – Electrical equipment operation (Switching Binary Electrical)
- **SBV** – Pneumatic/hydraulic equipment operation (Switching Binary Valve)

FB usage statisticks – Johan Sverdrup project





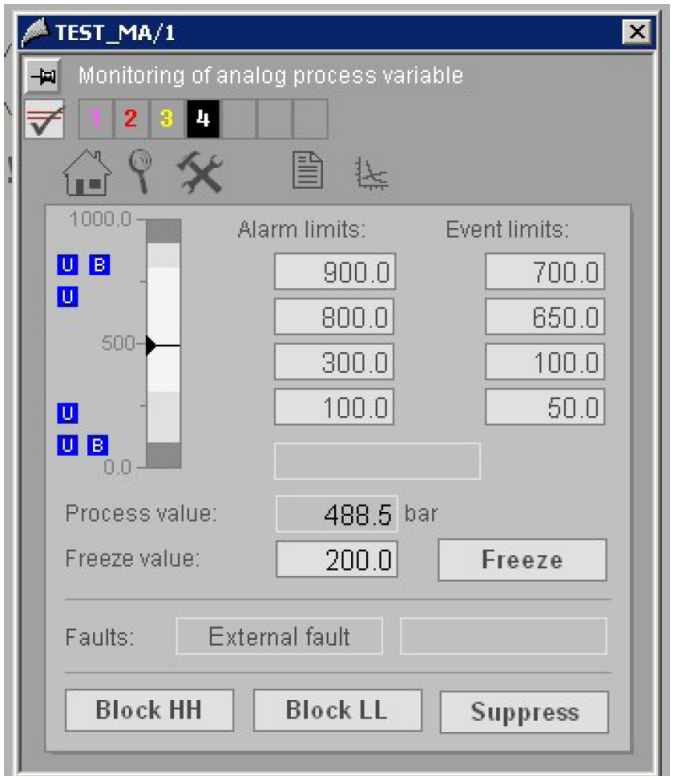
Total 8341



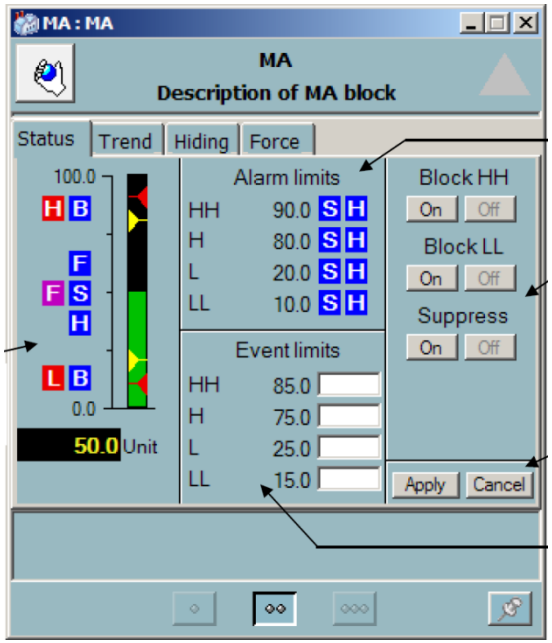
Total 7659

Standarisation of operation

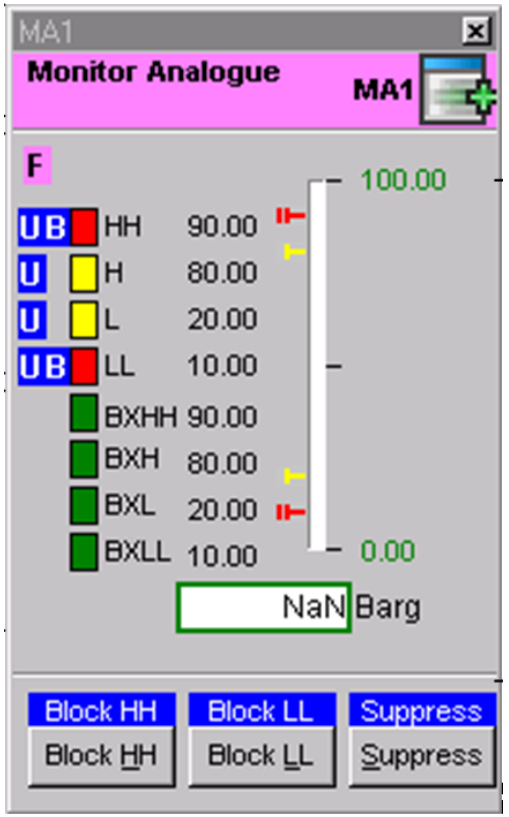
Vendor 1



Vendor 2

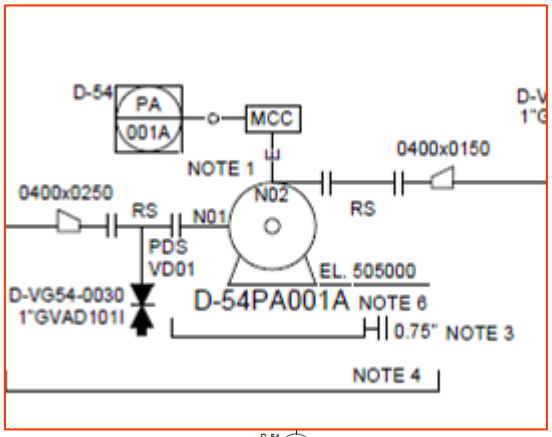


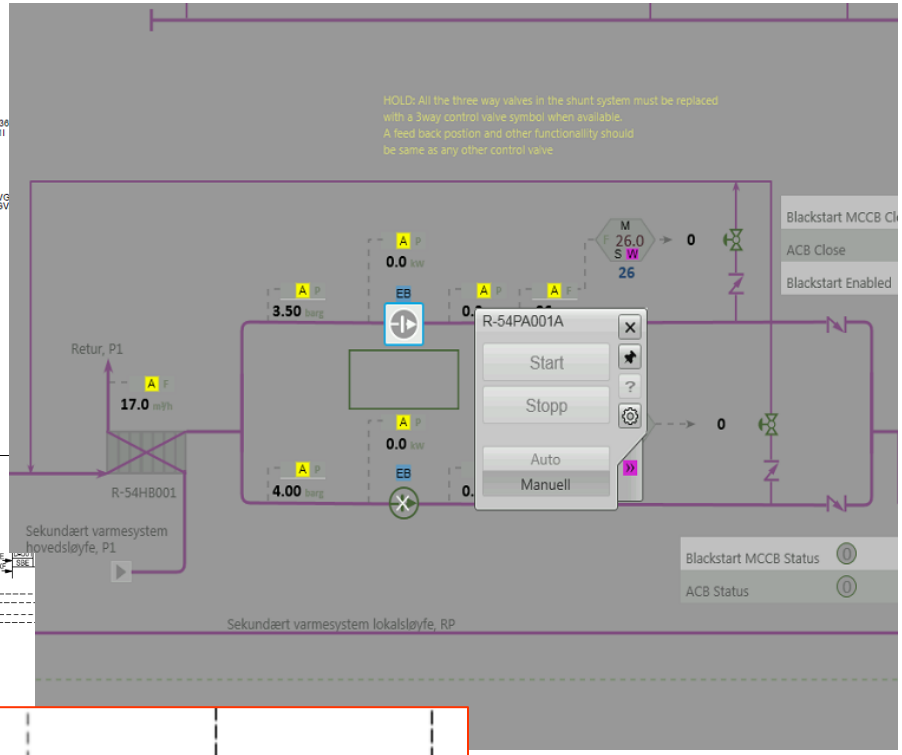
Vendor 3

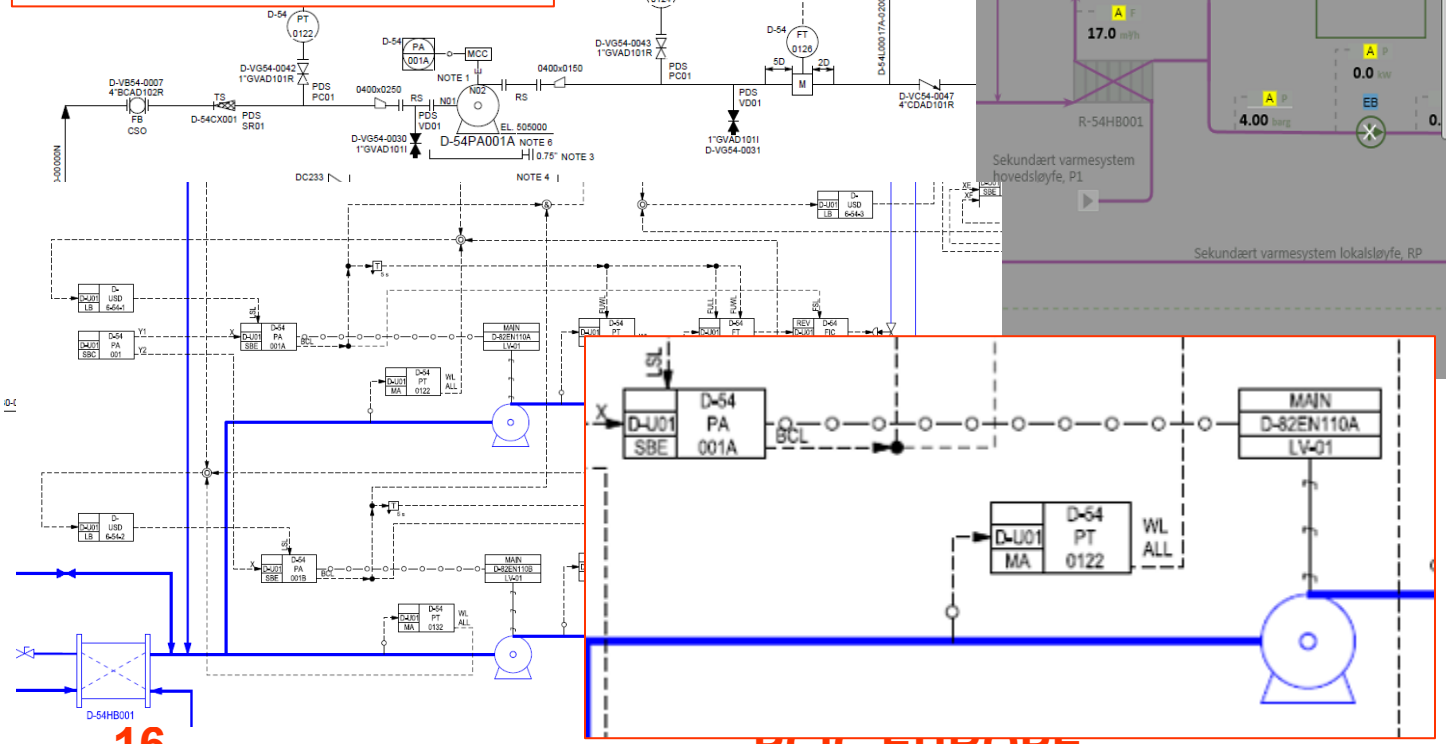


Object orientation

- Reduced need for tagging – the software object

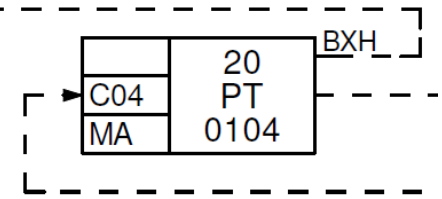






MA – Monitoring of Analog process value

A.4.6.2.1 Function template schematic



Inputs	MA		Outputs
Normal function input	X	Y	Normal function output
External fault	XF	YF	Function failed
Force blocking alarm HH	FBHH	AHH	Action alarm HH
Force blocking alarm LL	FBLL	BHH	Status alarm HH
Force suppression alarm HH	FUHH	WH	Warning alarm H [2)]
Force suppression alarm WH	FUWH	WL	Warning alarm L [2)]
Force suppression alarm WL	FUWL	ALL	Action alarm LL
Force suppression alarm LL	FULL	BLL	Status alarm LL
		BBHH	Action alarm HH is blocked
		BBLL	Action alarm LL is blocked
		BU	Status suppressed
		BB	Status blocked
		BXHH	Status event HH
		BXH	Status event H
		BXL	Status event L
			…its
Suppression on/off			Blocked
			Suppressed

AHH	binary output	Action alarm high-high	
ALL	binary output	Action alarm low-low	

BXH	binary output	Status event high status high	True, when X-value > Event high limit.No alarm annunciation, event only.
BXL	binary output	Status event low	True, when X-value < Event low limit. No alarm annunciation, event only.

…ate schematic

X and Y:

Normal Input (X) and Normal Output (Y) is **not** given terminal code on the SCD, unlike all other terminals.

SBV – Output control of a Binary Valve

A.4.15.2.1 Function template schematic

Inputs		SBV		Outputs
Position high feedback		XGH	Y	Normal function output
Position low feedback		XGL	YH	Pulsed normal function output high
				tion output low
				confirmed
External outside set low		XOL	BCL	Output position low confirmed
External fault		XF	BS	Status safeguarding
Lock safeguarding high		LSH	BB	Status blocked
Lock safeguarding low		LSL	BU	Status suppressed
Force safeguarding high		FSH	BA	Status auto/man
Force safeguarding low		FSL	BO	Status outside
Force disable transition high		FDH		
Force disable transition low		FDL		
Force blocking		FB		
Force suppression		FU		
Lock auto		LA		
Lock manual		LM		
Lock outside		LO		
Operator station:				Operator station:
Auto/Manual/Outside				Alarms and faults
				ed/Closing
				e
				Safeguarding
				Conflict

BCH	binary output	Output position high confirmed	Output Y compared to feedback position high from MCC or limit switch and validated as true
LSL	binary input	Lock safeguarding low .	**Safeguarding** - signal overrules operator inputs (locking the template to manual mode with Y- output to low -stop motor-). Input is subject to blocking. After signals disappear the template remains in manual mode and the output low.

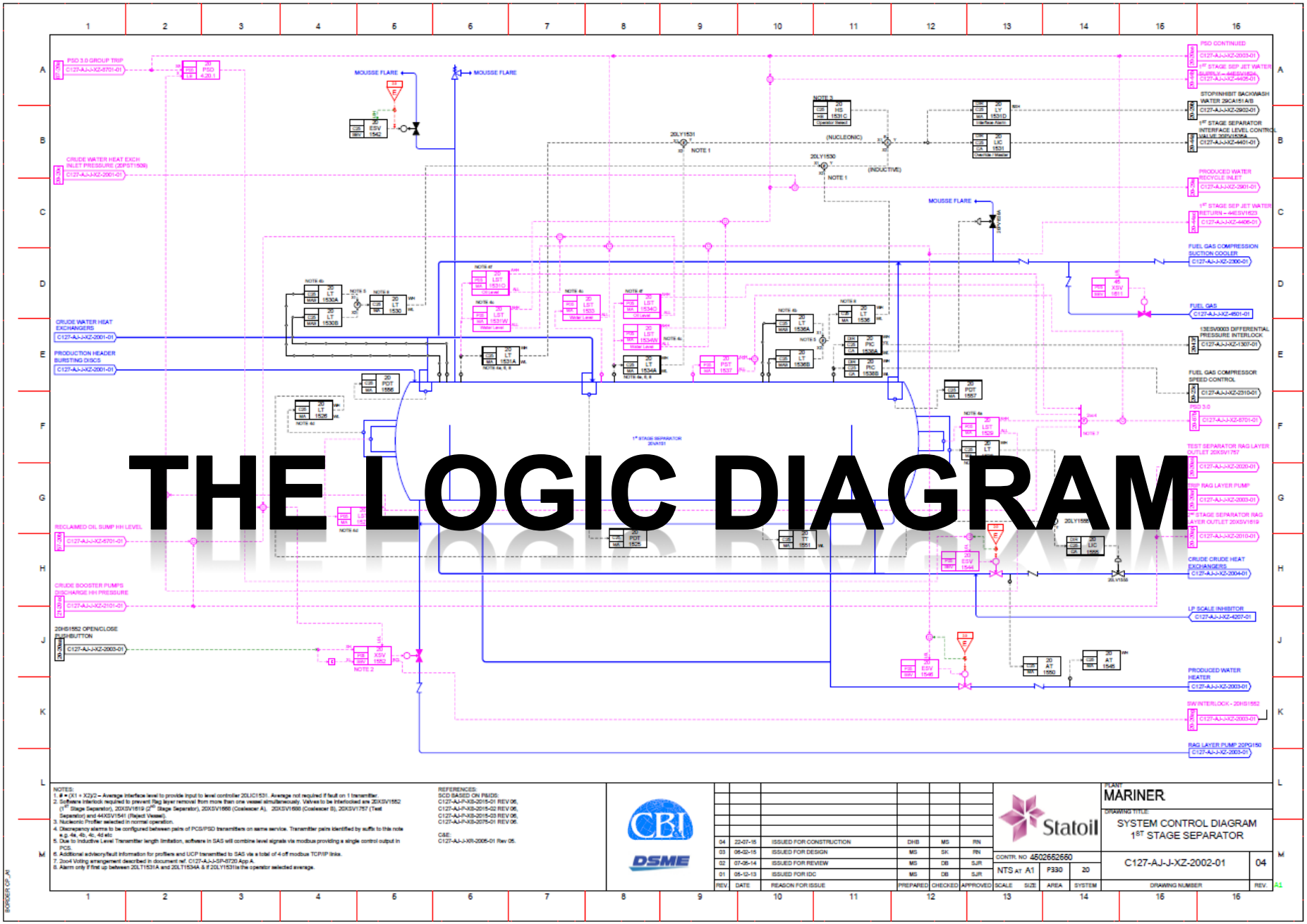
CA

A.4.3.2.1 Function template schematic

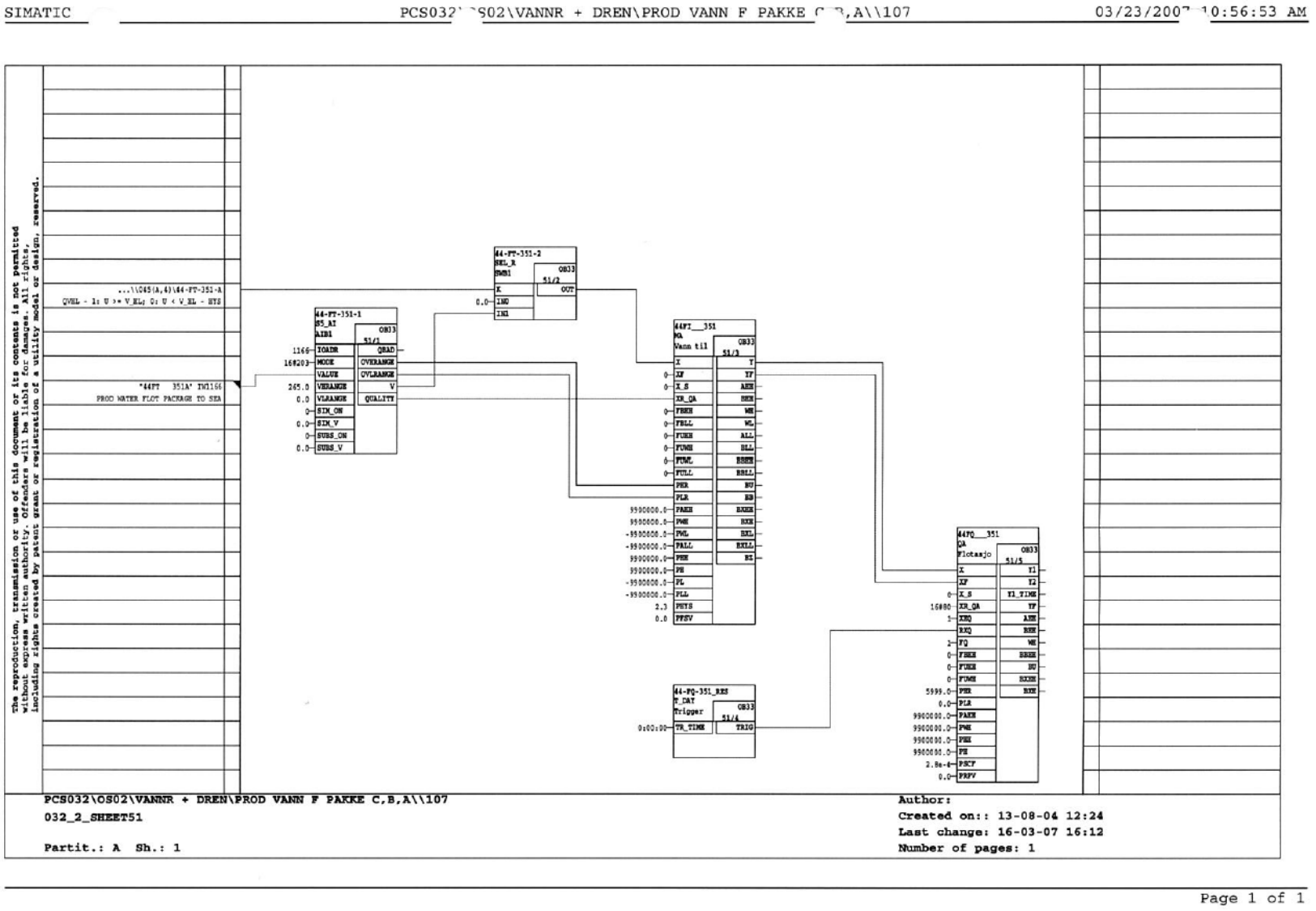
Inputs		CA		Outputs
Normal function input	X		Y	Normal function output
External fault	XF		YF	Function failed
External setpoint value	XR		YR	Reference setpoint value
External tracking value	XT		YX	Measured value output
Position low feedback	XGL		BCL	Output position low confirmed
Position high feedback	XGH		BCH	Output position high confirmed
Feed forward	XFF		BS	Status safeguarding
Lock safeguarding high	LSH		BB	Status blocked
Lock safeguarding low	LSL		BU	Status suppressed
Force safeguarding high	FSH		BA	Status auto/man
Force safeguarding low	FSL		BX	Status external/internal
Force tracking	FT		BT	Status tracking
Force blocking	FB		WV	Deviation warning[2)]
Force suppression	FU		WH	Warning alarm H[2)]
Lock auto	LA		WL	Warning alarm L[2)]
Lock manual	LM			
Lock external setpoint	LX			
Lock internal setpoint	LI			
Operator station:				Operator station:
Auto/Manual				Alarms and faults
Internal/External				Closed
Internal setpoint				Auto/Manual

LSH	binary input	Lock safeguarding high.	**Safeguarding** - signal overrules operator inputs (locking the template to manual mode with Y- output to high -open valve-). Input is subject to blocking .After signals disappear the template remains in manual mode and the output high.
LSL	binary input	Lock safeguarding low .	**Safeguarding** - signal overrules operator inputs (locking the template to manual mode with Y- output to low -stop motor-). Input is subject to blocking. After signals disappear the template remains in manual mode and the output low.

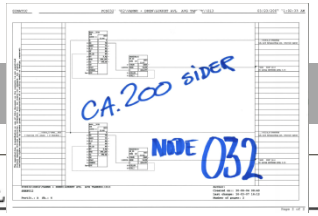
Figure A.2 - CA function template schematic


THE LOGIC DIAGRAM
PSD 3.0 GROUP TRIP
C127-AJ-J-XZ-5701-01
CRUDE WATER HEAT EXCH INLET PRESSURE (20PST1539)
C127-AJ-J-XZ-2001-01
CRUDE WATER HEAT EXCHANGERS
C127-AJ-J-XZ-2001-01
PRODUCTION HEADER BURSTING DISCS
C127-AJ-J-XZ-2001-01
RECLAIMED OIL SUMP HH LEVEL
C127-AJ-J-XZ-5701-01
CRUDE BOOSTER PUMPS DISCHARGE HH PRESSURE
C127-AJ-J-XZ-2101-01
20HS1552 OPEN/CLOSE PUSHBUTTON
C127-AJ-J-XZ-2003-01
MOUSSE FLARE
MOUSSE FLARE
(NUCLEONIC)
(INDUCTIVE)
MOUSSE FLARE
PSD CONTINUED
C127-AJ-J-XZ-2003-01
1ST STAGE SEP JET WATER SUPPLY – 44ESV1624
C127-AJ-J-44ESV1624
STOP/INHIBIT BACKWASH WATER 29CA151 A/B
C127-AJ-J-XZ-2902-01
1ST STAGE SEPARATOR INTERFACE LEVEL CONTROL VALVE 20ESV1536A
C127-AJ-J-XZ-4401-01
PRODUCED WATER RECYCLE INLET
C127-AJ-J-XZ-2901-01
1ST STAGE SEP JET WATER RETURN – 44ESV1623
C127-AJ-J-XZ-4406-01
FUEL GAS COMPRESSION SUCTION COOLER
C127-AJ-J-XZ-2300-01
FUEL GAS
C127-AJ-J-XZ-4501-01
13ESV0003 DIFFERENTIAL PRESSURE INTERLOCK
C127-AJ-J-XZ-1307-01
FUEL GAS COMPRESSOR SPEED CONTROL
C127-AJ-J-XZ-2310-01
PSD 3.0
C127-AJ-J-XZ-5701-01
TEST SEPARATOR RAG LAYER OUTLET 20XSV1757
C127-AJ-J-XZ-2020-01
TRIP RAG LAYER PUMP
C127-AJ-J-XZ-2003-01
1ST STAGE SEPARATOR RAG LAYER OUTLET 20XSV1619
C127-AJ-J-XZ-2010-01
CRUDE CRUDE HEAT EXCHANGERS
C127-AJ-J-XZ-2004-01
LP SCALE INHIBITOR
C127-AJ-J-XZ-4207-01
PRODUCED WATER HEATER
C127-AJ-J-XZ-2003-01
SW INTERLOCK - 20HS1552
C127-AJ-J-XZ-2003-01
RAG LAYER PUMP 20PD150
C127-AJ-J-XZ-2003-01
1ST STAGE SEPARATOR 20VA101
NOTES:
REFERENCES:
CBI
DSME
Statoil
PLANT: MARINER
DRAWING TITLE: SYSTEM CONTROL DIAGRAM 1ST STAGE SEPARATOR
CONTR. NO 4502652660
NTS AT A1
P330
20
C127-AJ-J-XZ-2002-01
04
DRAWING NUMBER
REV.
A1
04 22-07-15 ISSUED FOR CONSTRUCTION DHB MS RN
03 06-02-15 ISSUED FOR DESIGN MS SK RN
02 07-05-14 ISSUED FOR REVIEW MS DB SJR
01 05-12-13 ISSUED FOR IDC MS DB SJR
REV DATE REASON FOR ISSUE PREPARED CHECKED APPROVED

Logic Diagrams for the programmer



FRD vs SCD



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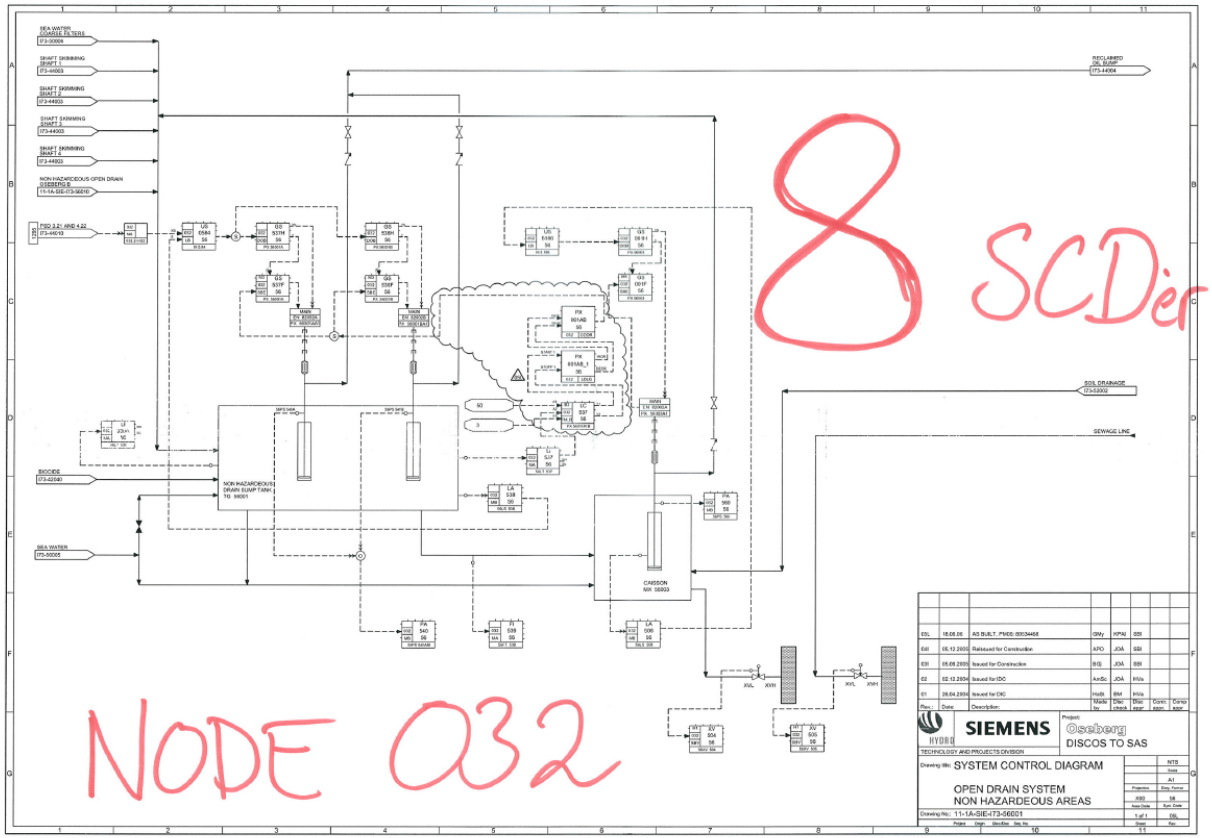

...\\010(A,4)\PX44004A
LSL Lock Safeguarding Low, overrule operat

"44GS 301H" Q3.0
PX 44004A SHUTDOWN LEVEL 5.35

...\\011(A,4)\PX44004B
LSL Lock Safeguarding Low, overrule operat

"44GS 302H" Q4.6
PX 44004B SHUTDOWN LEVEL 5.35

32

PCS032\OS02\VANNR + DREN\LUKKET AVL AVG TANKER\\013
SHEET12

Partit.: A Sh.: 4

Author:
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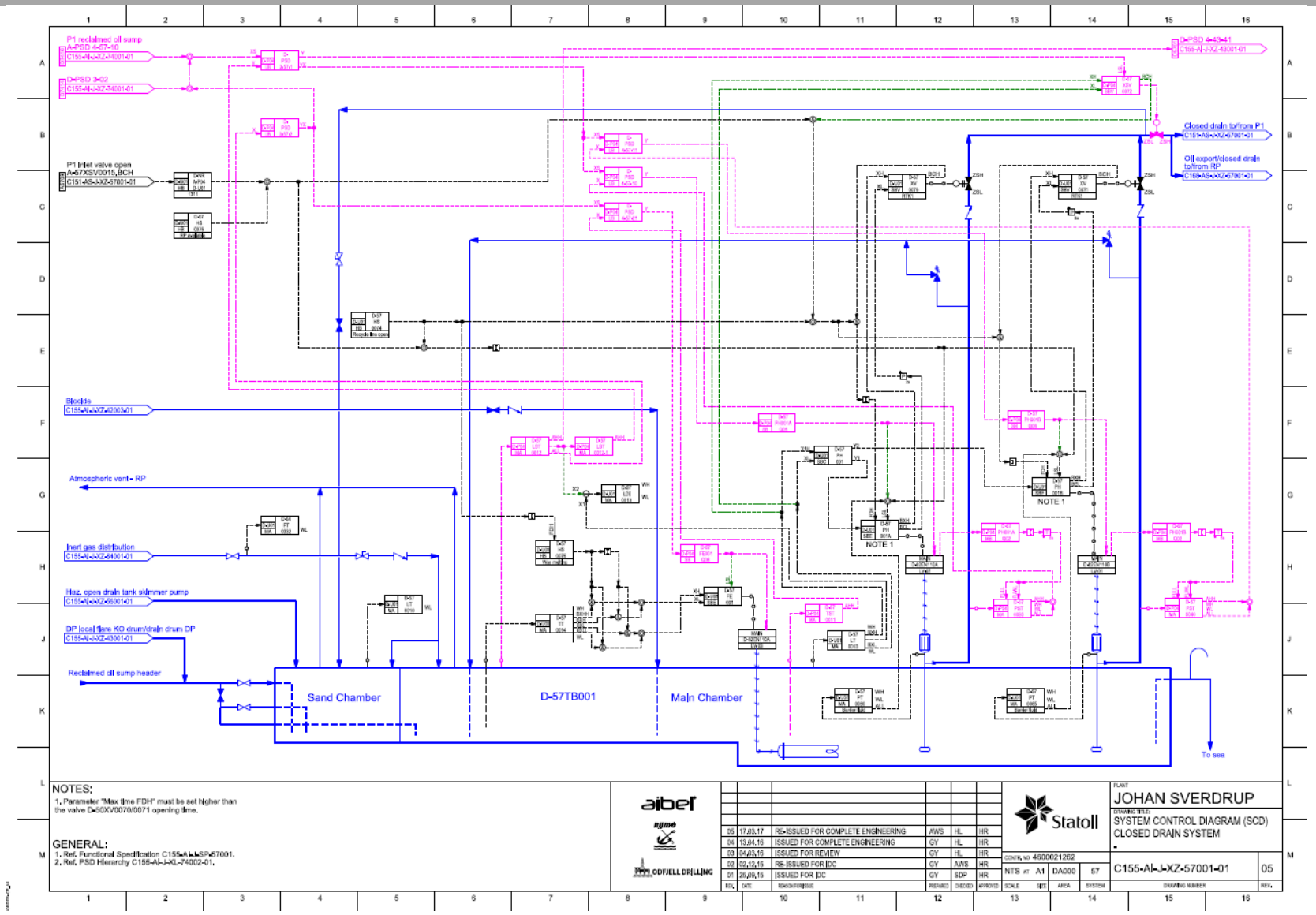
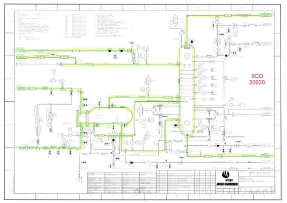
Last change: 16-03-07 16:12
Number of pages: 2

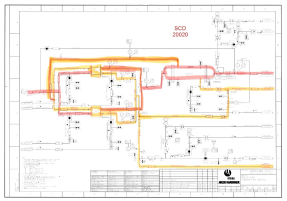
Page 2 of 2

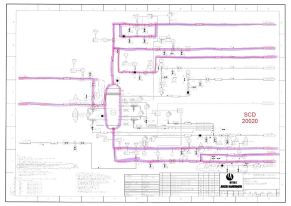
Logic Diagrams for all «Stakeholders»

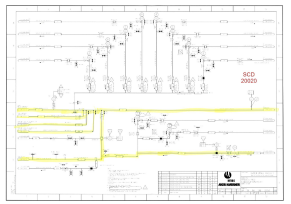


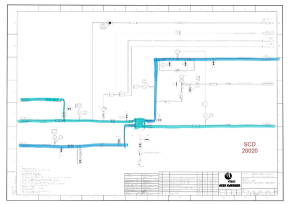
Extent P&ID vs SCD

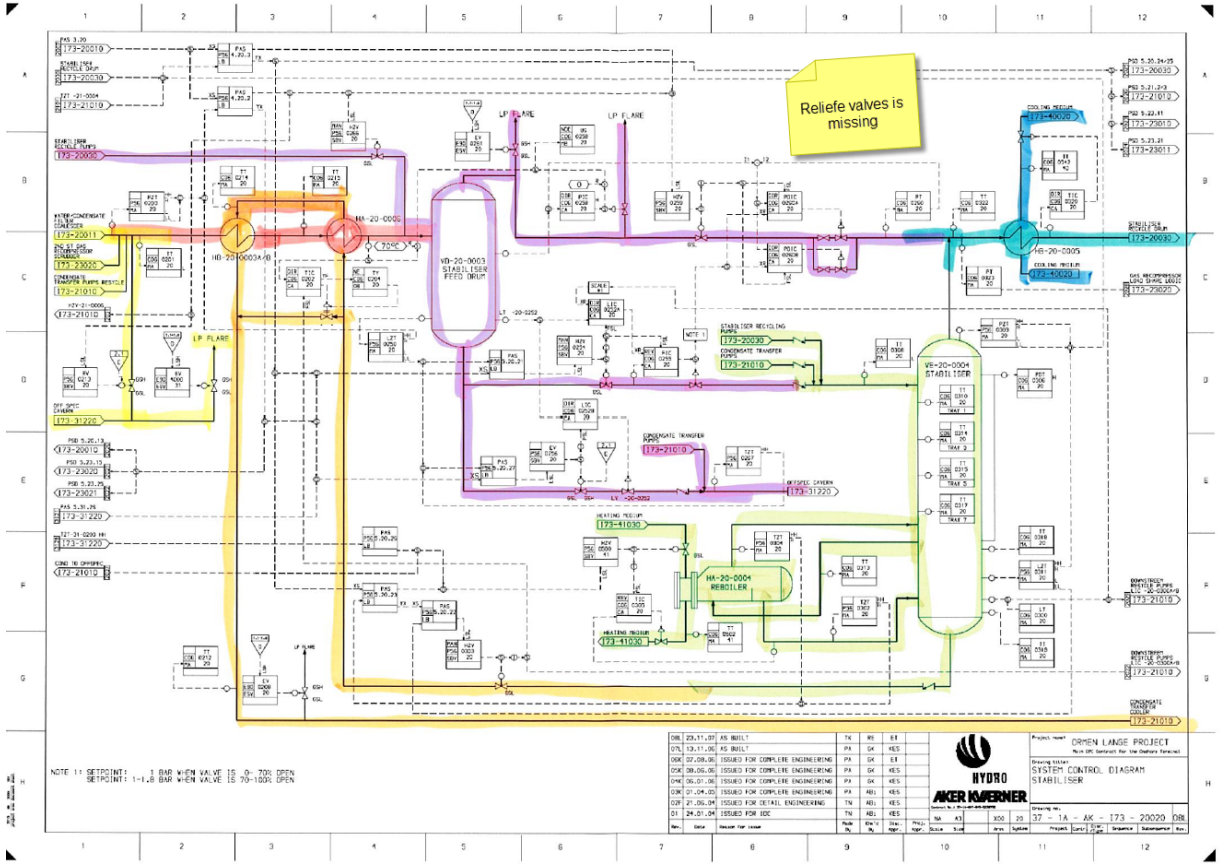




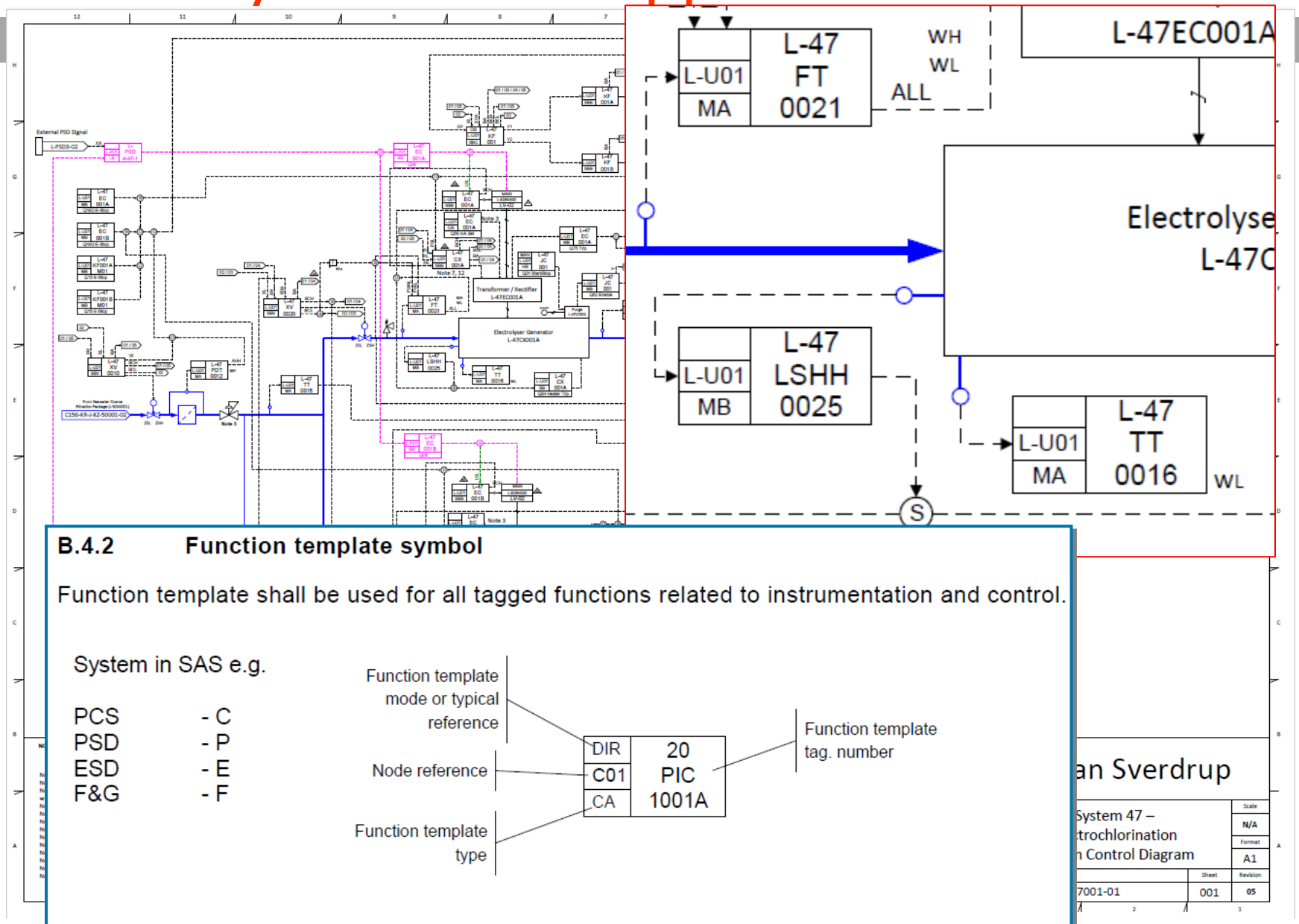








The main symbol - The Application Blocks



B.4.2 Function template symbol

Function template shall be used for all tagged functions related to instrumentation and control.

System in SAS e.g.

PCS	- C
PSD	- P
ESD	- E
F&G	- F

Figure B.1 - The function template symbol

an Sverdrup

System 47 –
trochlorination
n Control Diagram

Scale	N/A
Format	A1
Sheet	001
Revision	05

7001-01

Elementary Function Bl

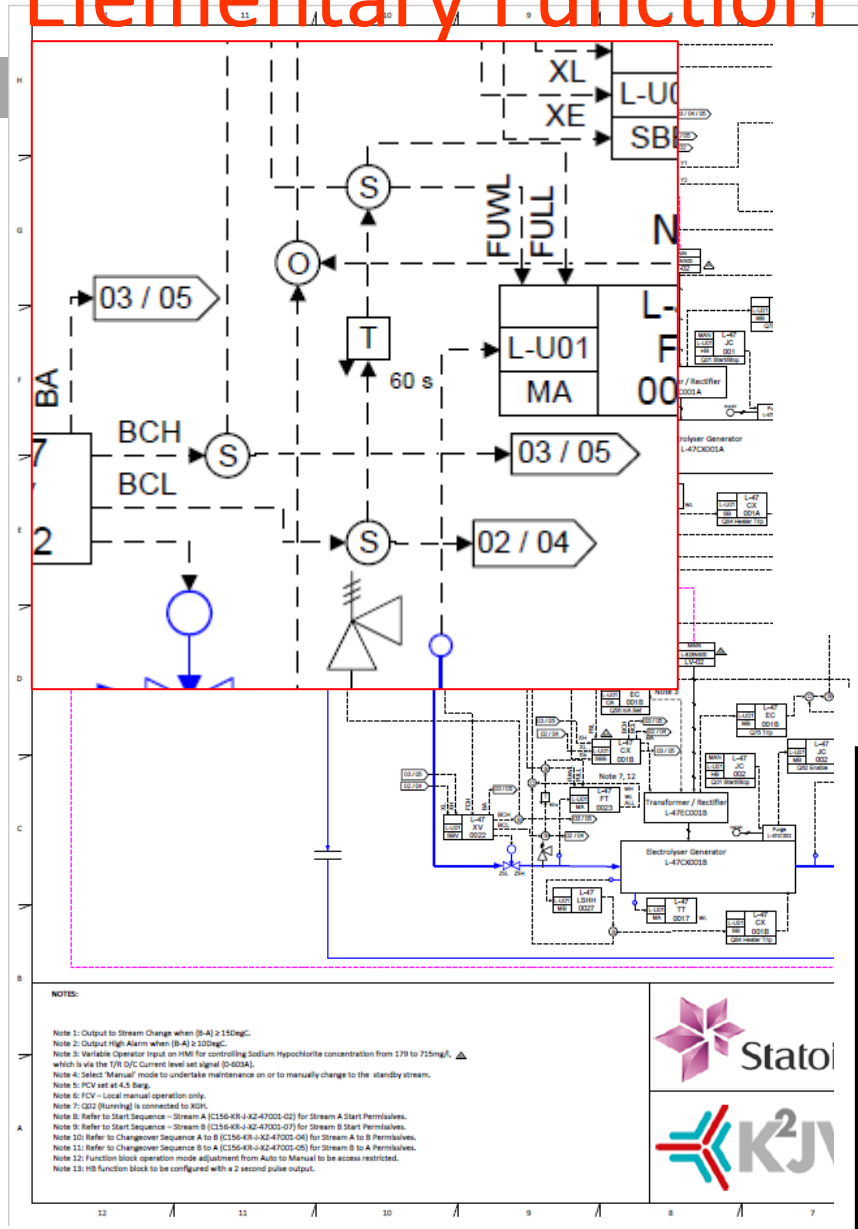


Table B.3 - Timer/pulse logic diagrams

Description	Symbol	Logic diagram
		A
Inverter	A – I – C	C
Timer (delay on rising edge)	A – T – C, 5 s	C
Timer (delay on falling edge)	A – T – C, 5 s	C
Pulse generator (pos. pulse on false – true)	A – P – C, 5 s	C
Pulse generator (pos. pulse on true – false)	A – P – C, 5 s	C

Table B.2 - EFB function notations

Notation	Function	Extended connection line	Terminals to be shown
o	Logic "OR" (X1 or X2 = Y)	Can be used	NA
&	Logic "AND" (X1 and X2 = Y)	Can be used	NA
≠	Logical "XOR" (Exclusive X1 or X2, Y=1)	Can be used	NA
H	High selector (Y = the higher of X1 and X2)	NA	NA
L	Low selector (Y = the lower of X1 and X2)	NA	NA
>	Comparator high (Y = 1 when X1 > X2, otherwise Y = 0)	NA	X1,X2
<	Comparator low (Y = 1 when X1 < X2, otherwise Y = 0)	NA	X1,X2
+	Arithmetic plus (X1 + X2 = Y)	NA	NA
-	Arithmetic minus (X1 - X2 = Y)	NA	X1,X2
*	Arithmetic multiply (X1 * X2 = Y)	NA	NA
/	Arithmetic division (X1 / X2 = Y)	NA	X1,X2
M	Memory element (S=set, R=reset) [1)]	NA	S,R
S	Split of signal	NA	NA
#	Optional formula – Terminal names users choice. See figure B.8.	Can be used	All
A	Analogue select by digital input Y=X1 when S=0, Y=X2 when S=1	NA	S,X1,X2

1) Dominant terminal to be indicated by underlining the terminal name. If no terminal is underline R=reset is to be considered dominant.

PCI

Positive logic - High or Low

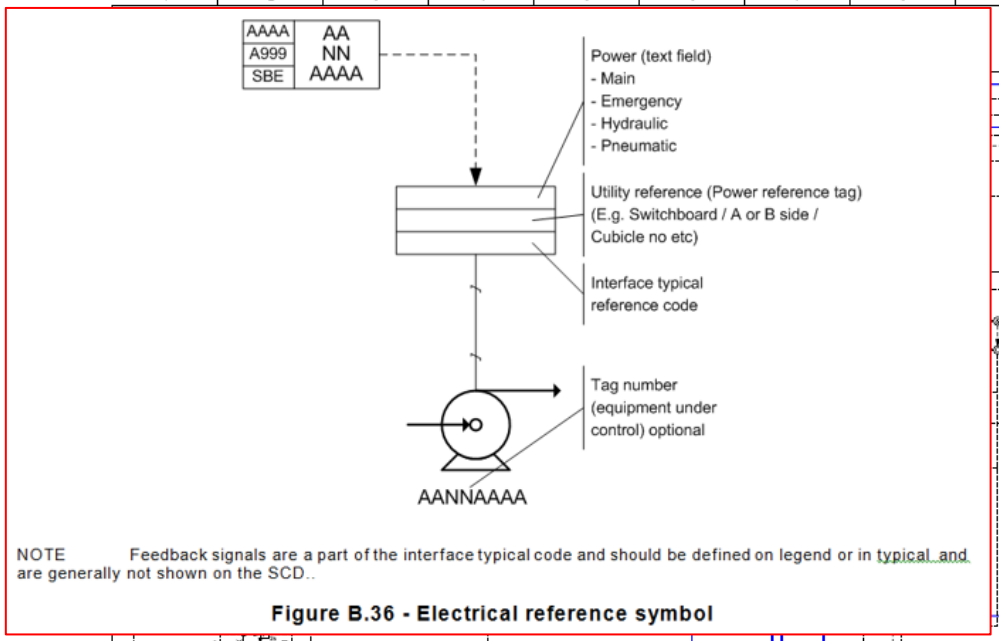
- High (H)
  - Valve Open
  - Motor Start
  - Heater On
  - Connector Connected
- Low (L)
  - Valve Closed
  - Motor Stop
  - Heater Off
  - Connector Disconnected

NOTE! SCD are ALWAYS drawn with positive logic

Signal ACTIV = ON (PÅ) = OPEN (ÅPEN) = HIGH (HØY) = 1 = True = Positive

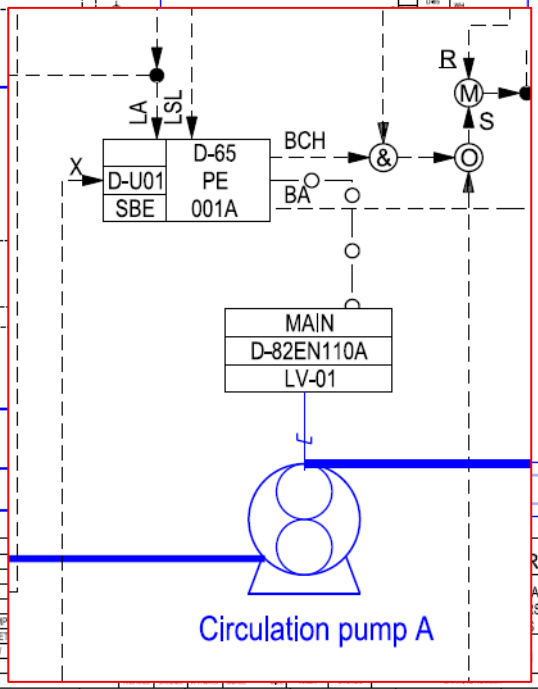
Signal NOT ACTIVE = OFF (AV) = CLOSED (LUKKET) = LOW (LAV) = 0 = False = Negativ

Electrical reference symbol

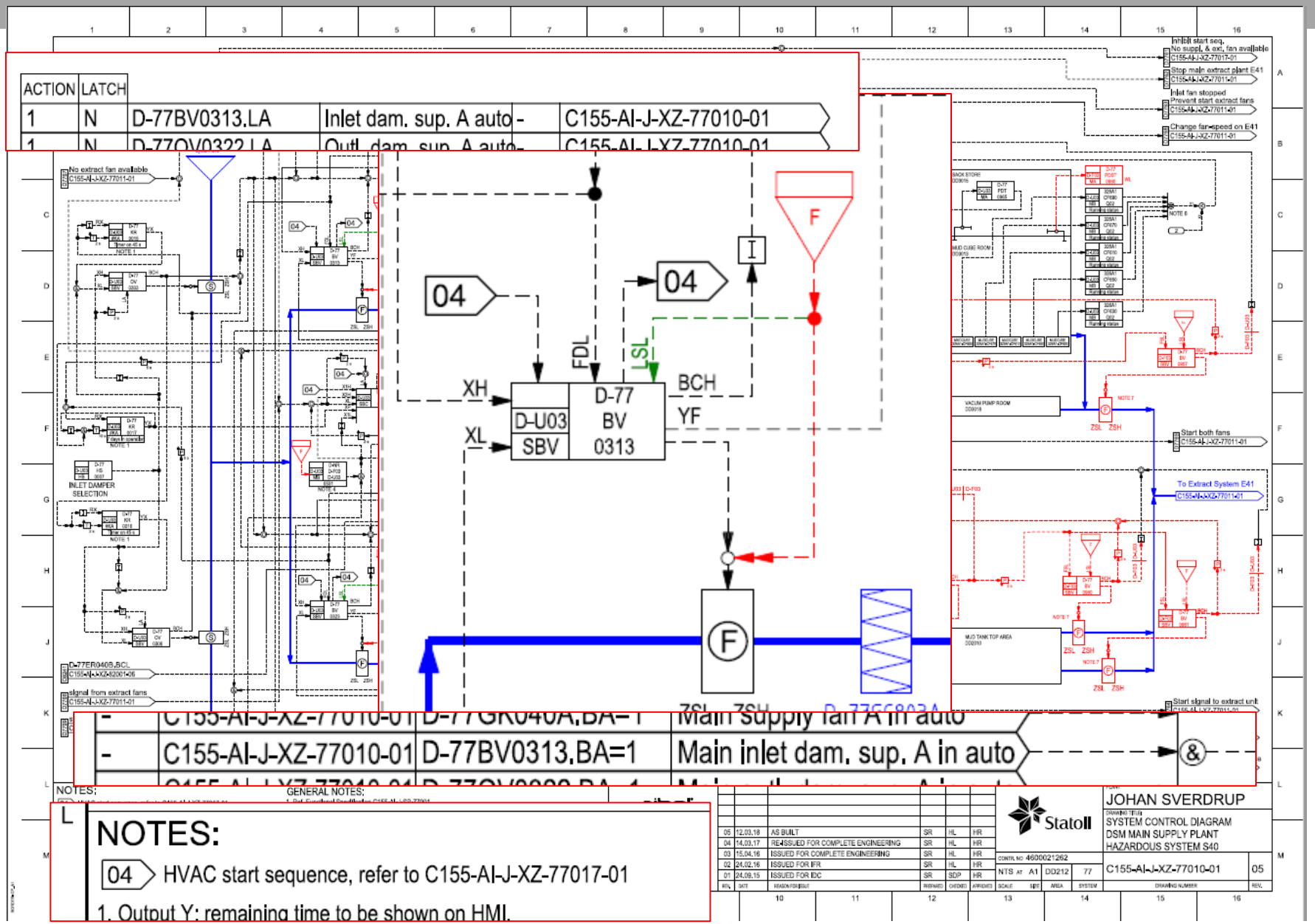


NOTE Feedback signals are a part of the interface typical code and should be defined on legend or in typical and are generally not shown on the SCD..

Figure B.36 - Electrical reference symbol

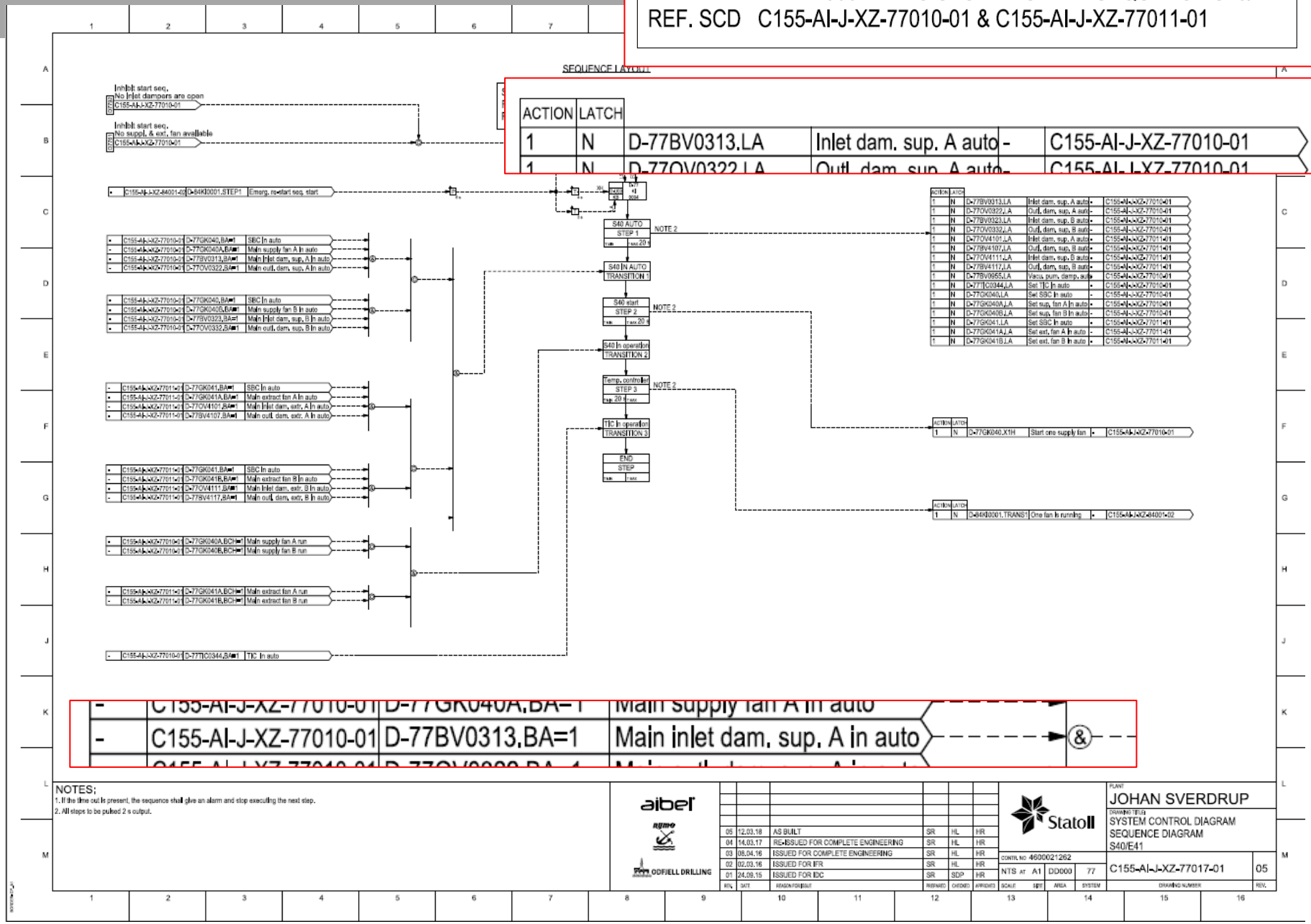


Sequence by Sequential Function Charts (SFC)



The SFC SCD

SEQ.	04
FB	D-77KI0004 HVAC SYSTEM START SEQUENCE S40/E41
REF. SCD	C155-AI-J-XZ-77010-01 & C155-AI-J-XZ-77011-01



A.4.13.2 Technical description

A.4.13.2.1 Function template schematic

Inputs	SBC		Outputs
Auto start requested number	XH	Y1 – Y6[8)]	Normal function output
Auto stop all	XL	YF	Function failed
Enable function	XE	YQ	Number requested
Request number	XQ	BA	Status auto/man
Rotate priority	XP	BCH	One or more SBE in run
		BCL	All SBE in stop
Call for 6 - increasing	X6H	BCQ	Number running
Call for 5 - increasing	X5H		
Call for 4 - increasing	X4H		
Call for 3 - increasing	X3H		
Call for 2 - increasing	X2H		
Call for 1 - increasing	X1H		
Call for 5 - decreasing	X5L		
Call for 4 - decreasing	X4L		
Call for 3 - decreasing	X3L		
Call for 2 - decreasing	X2L		
Call for 1 - decreasing	X1L		
Lock auto	LA		
Lock manual	LM		
Operator station:			Operator station:
Start requested			For each SBE :
Stop all			Running/stopped
Increment			Alarms and faults
Decrement			Available (SBE in auto)
Shift			Start disabled (FDH)
Set priority for each SBE			Stop disabled (FDL)
Set number requested as value			Safeguarding
Suppression on/off			Current priority
			Suppressed
Information from SBE[6)7)]			Information to SBE[6)]
• Running			• Set high
• Failure			• Set low
• Enabled for duty/standby (auto mode)			• Priority
• Safeguarding			
• Start disabled (FDH)			
• Stop disabled (FDL)			

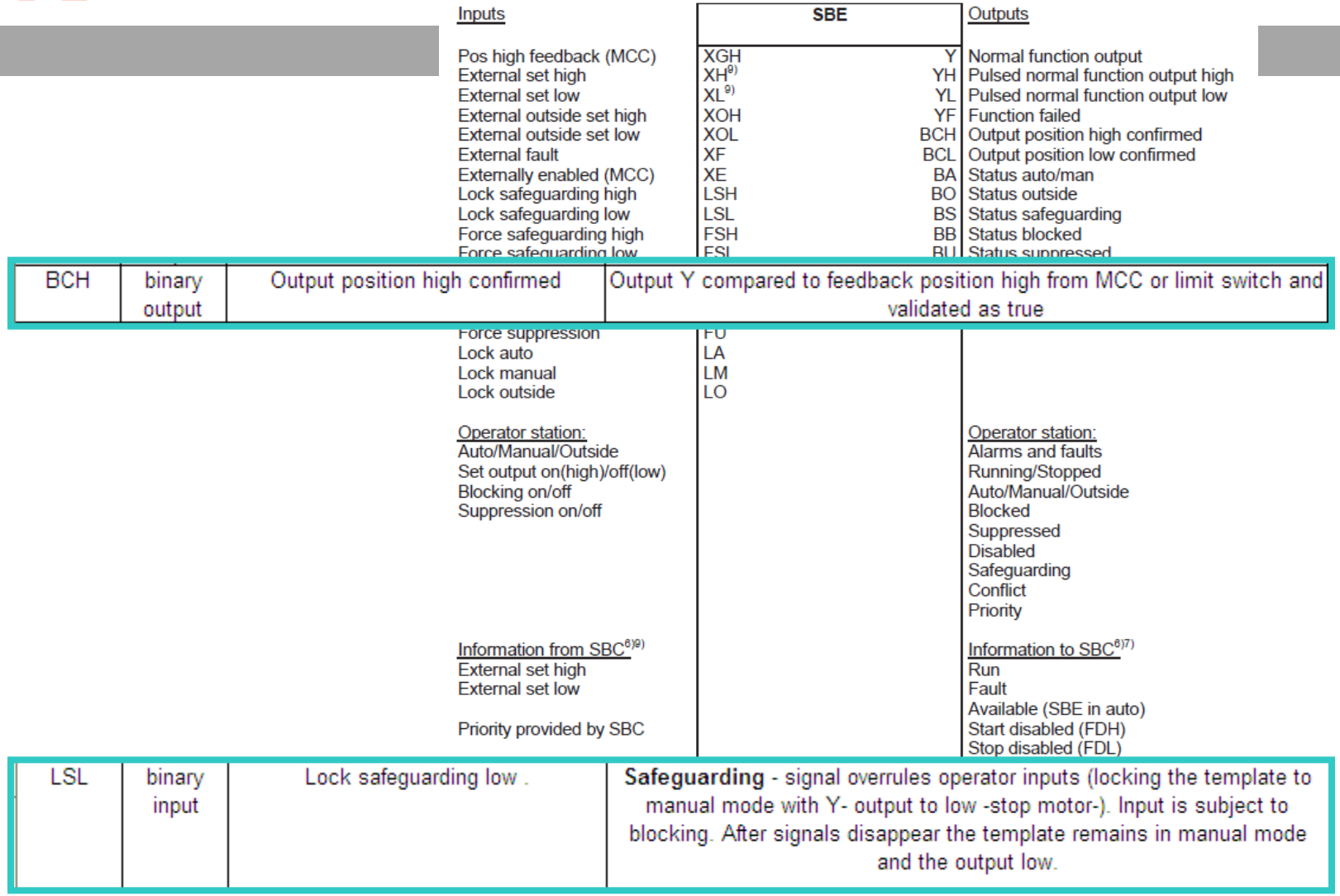
6) Dependent of vendor solution.

7) Will not be shown on SCD

8) Terminal name will be shown as Y1...Y6 connected to X on SBE 1 .. 6 on the SCD.

Figure A.15 - SBC function template schematic

SBE

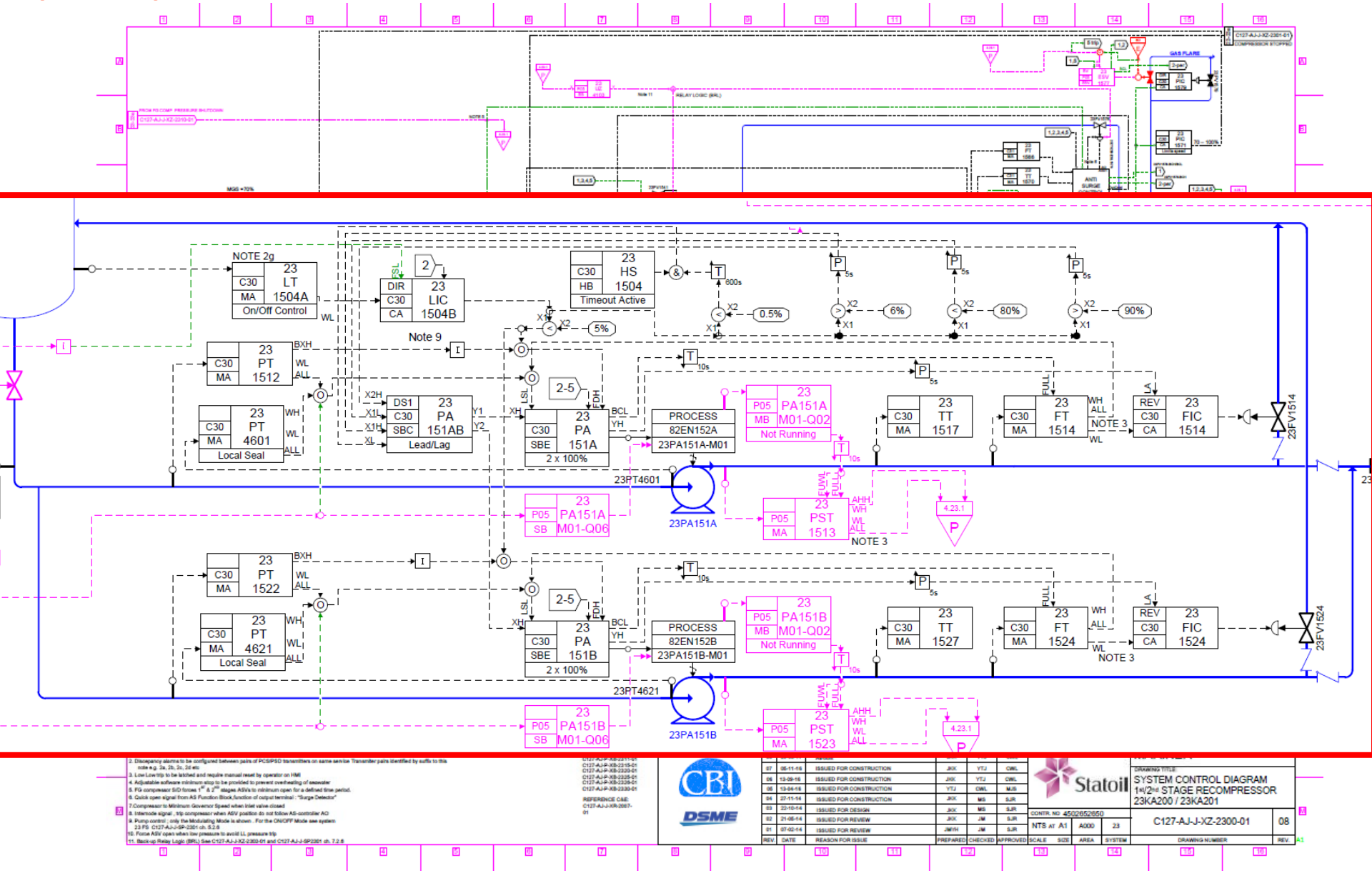


7) Will not be shown on SCD.

9) Terminal name will be shown as X connected to Y1....Y6 on SBC on the SCD.

Figure A.16 - SBE function template schematic

An example – one measurement controls several pumps



A.4.12.2.1 Function template schematic

Inputs		SBB		Outputs
Position high feedback (connected/closed)	XGH		Y	Normal function output
Position low feedback (disconnected/open)	XGL		YH	Pulsed normal function output high (connect/close)
External set high	XH		YL	Pulsed normal function output low (disconnect/open)
External set low	XL		YF	Function failed
External outside set high	XOH		BCH	Output position high confirmed (connected/closed)
External outside set low	XOL		BCL	Output position low confirmed (disconnected/open)
External fault	XF		BE	Status enabled
Function externally enabled	XE		BA	Status auto/man
External test position	XGX		BO	Status outside
External earthed	XGZ		BS	Status safeguarding
Lock safeguarding high	LSH		BB	Status blocked
Lock safeguarding low	LSL		BU	Status suppressed
Force safeguarding high	FSH			
Force safeguarding low	FSL			
Force disable transition high	FDH			
Force disable transition low	FDL			
Force blocking	FB			
Force suppression	FU			
Lock auto	LA			
Lock manual	LM			
Lock outside	LO			
Operator station				Operator station
Auto/Manual				Alarms and faults
Close (high)/ Open (low)				Open (disconnected) / Closed(connected)
Blocking on/off				Suppressed
Suppression on/off				Auto/Manual/Outside
				Earthed
				Available
				Test mode
				Blocked
				Disabled
				Safeguarding
				Conflict

Figure A.14 - SBB function template schematic

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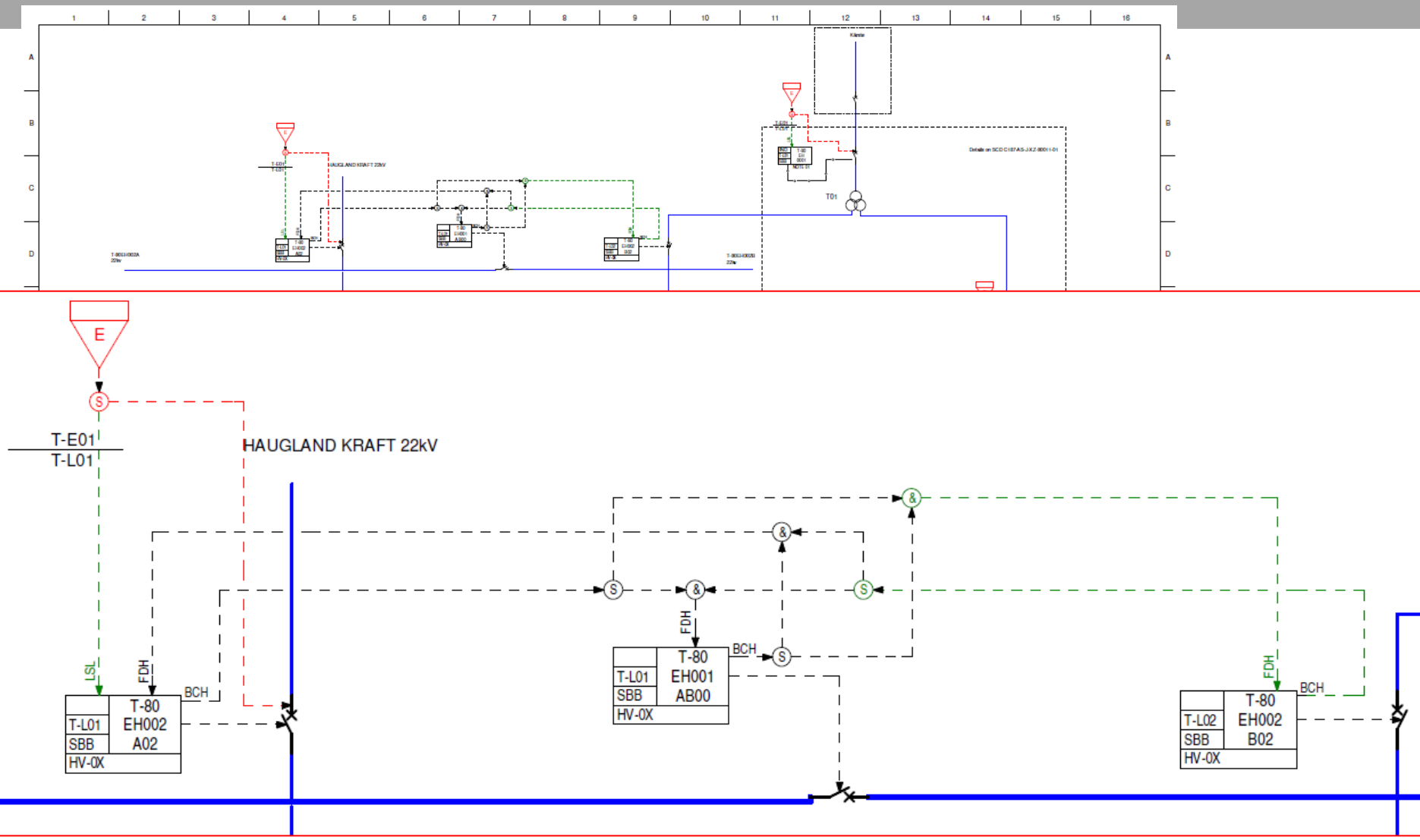
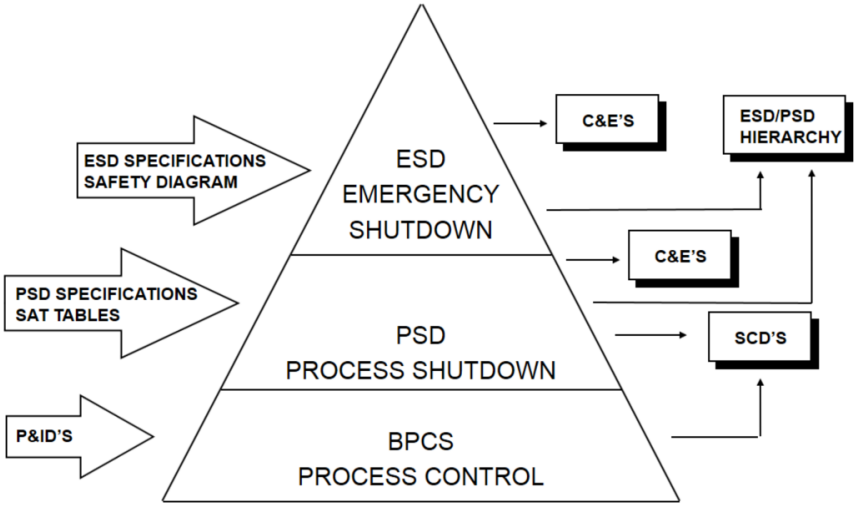
Power distribution SCD example - SBB

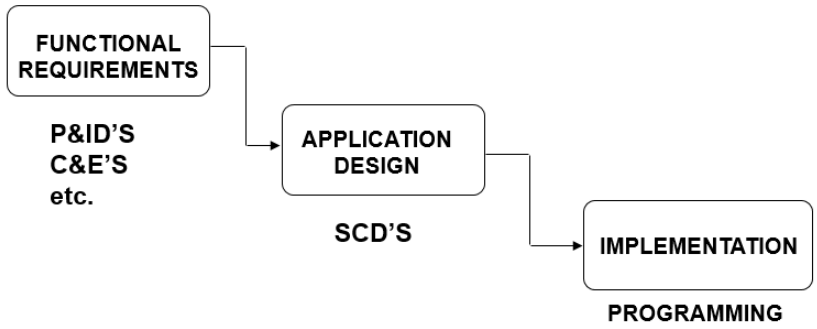


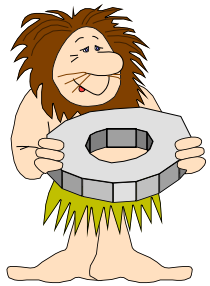
THE METHOD

Application design

- The SCDs should be jointly developed by the system disciplines, driven by user requirements, not by technology/discipline organization.
- The SCDs should as far as possible be developed in parallel with the P&IDs.



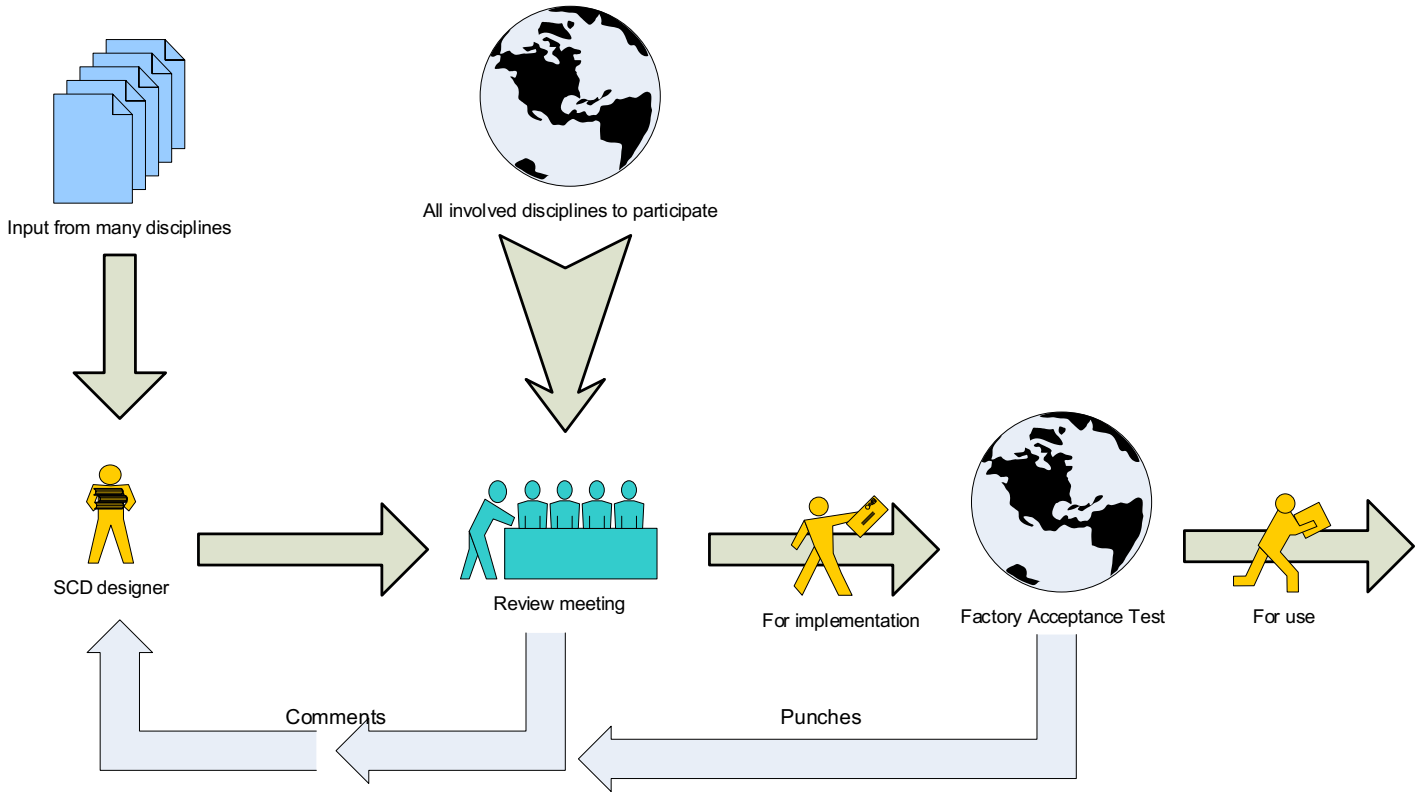




Predefined operational functions

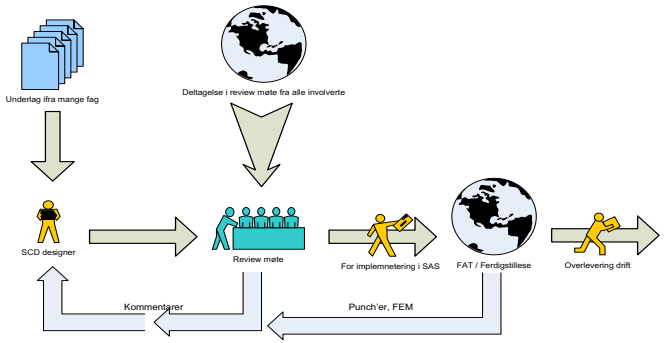
- The P&ID developed by process department identifies the controllable objects. i.e instruments, valves, compressors, sentrifuges, pumps, heaters etc.
- Each object have their standard way to be operated, “PCE request” (P&ID) → Functblock (SCD) → attributes, the FB is an independent object itself.
- There will be some FB’s that are not directly a “child” of an P&ID object. We should not make the need for them to be present on the P&ID.
- The “PCE requests” we have on the P&ID is much simpler identified, it is when you use the “Shared display/control” symbol (ref ISA 5.1) . But again they will only link to some of the FB’s

SCD cooperation – The review meeting



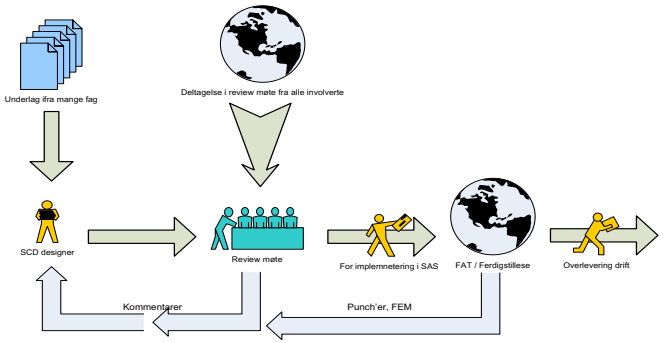
SCD'er – A multidiscipline cooperation

- The SCD methodology should create a common understanding across the involved disciplines, of how the equipment and process are controlled/operated
- Prepartion of SCD's is started early
- Based on documents from other disciplines, mechanical package and their attendance in "SCD review" meetings
- Used in HAZOP and other multidisciplinary reviews
- Basis for programming of logic
- Verified against during FAT
- Used by Commissioning
- Used for training



Other disicipline contributions to SCD

- Define instrumentation location and shutdown alarm actions (trip).
- Proposed control strategies and structures
- Point out considerations that must be taken care of with respect to control strategy in terms of limitations on equipment and process design
- Clarify requirements for startup and shutdown
- Define shutdown valves location and their function in terms of process shutdown and pressure relief
- Ensure that requirements for maintenance operability is followed
- Input documentation:
  - P&IDs, C&E, Shutdown hierarchy
  - D&IDs
  - Safety philosophies, SAT tables
  - Package suppliers P&ID's/ Control narratives / Logic diagrams / C&E



Supporting Functional specification

– ICSS FS

App A FS Template example (INFORMATIVE)

Document No.: XXXXXXXXXXXXXXX	Rev.: 02	Page: 26 of 21
Classification Code: Originator: XXX Tag No.: System No. : *XX* Area Code:		
All text in blue and italic shall be modified to suit each specific document, i.e. deleted, re-written or expanded. No numbered section shall be deleted. Superfluous numbered sections shall have the text "Not applicable". Additional numbered sections may be included. CTR No.: Document Title: SAS FUNCTIONAL SPECIFICATION TEMPLATE *Document titles shall be:* ***SAS FUNCTIONAL SPECIFICATION SYSTEM <SYST.NO> <SYSTEM NAME>*** *e.g.:* ***SAS FUNCTIONAL SPECIFICATION SYSTEM XX GAS COMPRESSION AND RE-INJECTION SYSTEMS***		

02	*DD.MM.YYYY*	ISSUED FOR ITT				
01	*DD.MM.YYYY*	ISSUED FOR CLIENT REVIEW				
Rev.	Issue date	Description	Made by	Chk'd by	Disc. Appr.	Proj. Appr.

Project no.:*XXXXXX*	Contract No.: *XXXXXXXXXX*
Plant X	

A.1 RESPONSIBILITY MATRIX FOR THIS DOCUMENT

Insert NA in column "Representative" in all rows that are not relevant. Expand with additional rows as needed, e.g. to accommodate additional packages.
Each responsible party's signature below confirms that the parts of this document that are relevant for that party have been worked out in a manner satisfactory to that party, and that the result is complete and acceptable to that party.
The Instrumentation discipline is formally responsible for this document. The signature of the Instrumentation representative is found on the front sheet, and is not relevant here.

Responsible party	Package	Representative	Initials	Signature	Date	Notes
Instrumentation[1]	XXXX			See front sheet	See front sheet	
Process[2]	XXXX					
Safety[3]	XXXX					
HVAC[4]	XXXX					
Electrical[5]	XXXX					
SAS package vendor[6]	*XXXX*					
Package vendor[7]	*XXXX*					*1*
MTO workgroup[8]	XXXX					
Subcontractor[9]	XXXX					

If a signature applies only to part of the document, e.g. for MTO signature for VDU picture specifications, this may be documented in the form of a note.
Notes:

Insert any reservations that "Responsible party" needs to make in order to sign the matrix, e.g.: Strategy for control of xxx can not be finalised at this time, because of ...

Insert NA in column Representative for rows that is not applicable.

Supporting Functional specification

1.2 Scope

This document covers monitoring and control of system *<syst.no>*, *<system name>*, by SAS directly, and/or indirectly via separate control systems where relevant. The document shall contain, either directly or by reference:

- Brief description of the process to be controlled (section 2)
- Description of the protective functions, including detailed specification of all SAS safety system functionality to be implemented for this system (section 4)
- Detailed specification of all non-protective SAS functionality to be implemented in SAS for this system, as well as listings of alarm groups and trends/reports (section 5)

Relevant Process system description, Operational Manual, System Control Diagrams (SCDs), control sequence specifications/tables, Cause & Effect charts, HMI screens and package specifications are referenced.

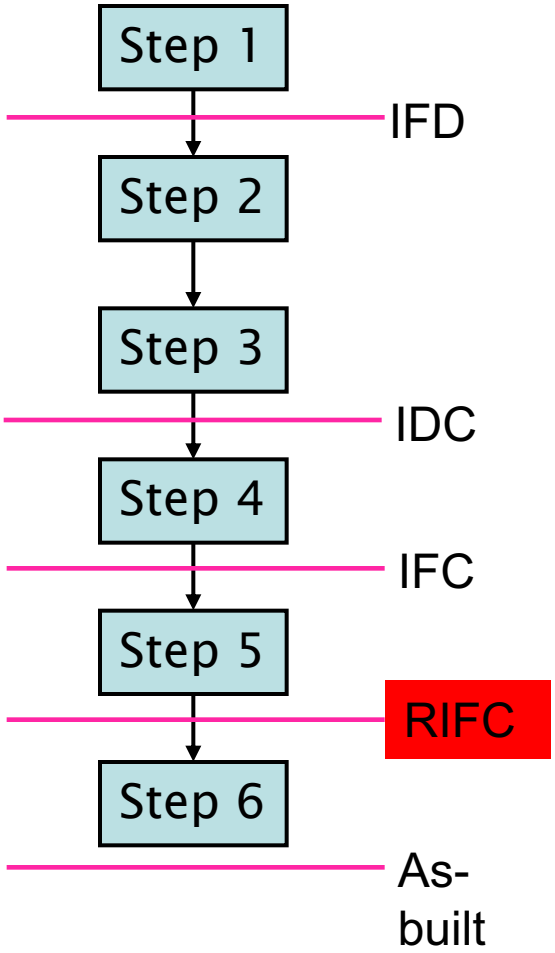
For efficiency and maintainability, references shall be used instead of text whenever there exists an official document with sufficient quality that can be referenced.

Supporting Functional Specification

Table of Contents

SCD development sequence - General

- SCD shall have complete **multi-disciplined IDC check** at each release
- IDC prior to release for implementation is done in the form of a **technical review meeting** where all parties are present.
- SCD ' are distributed to those who get the P & ID's
- SCD ' are being developed and issued pr. process system
- Suggestions: 6 step sequence

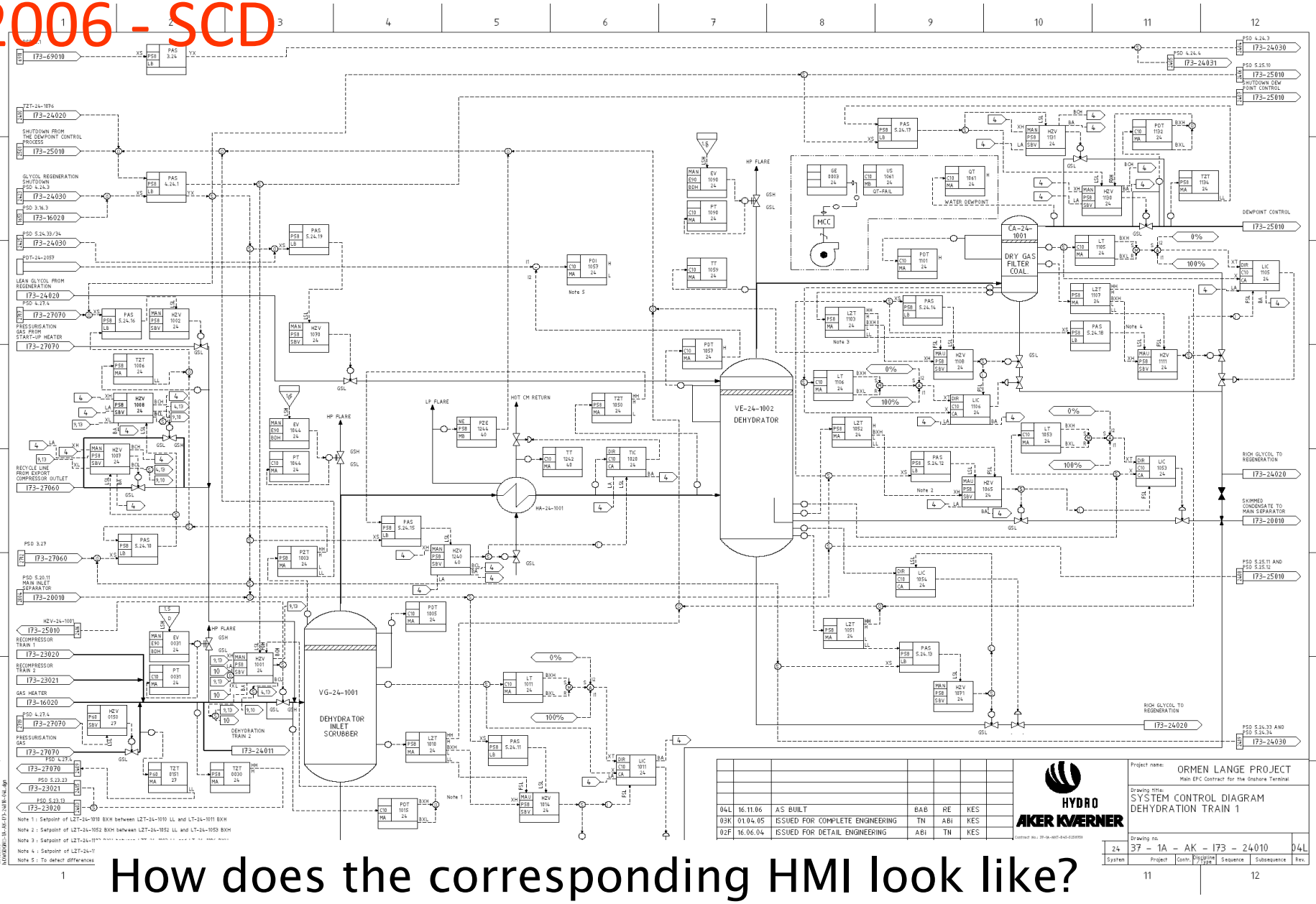


Export of SCD to DCS supplier

Johan Sverdrup phase 2 will digitalise the SCD export to DCS supplier in the purpose of automatically generate the control application.

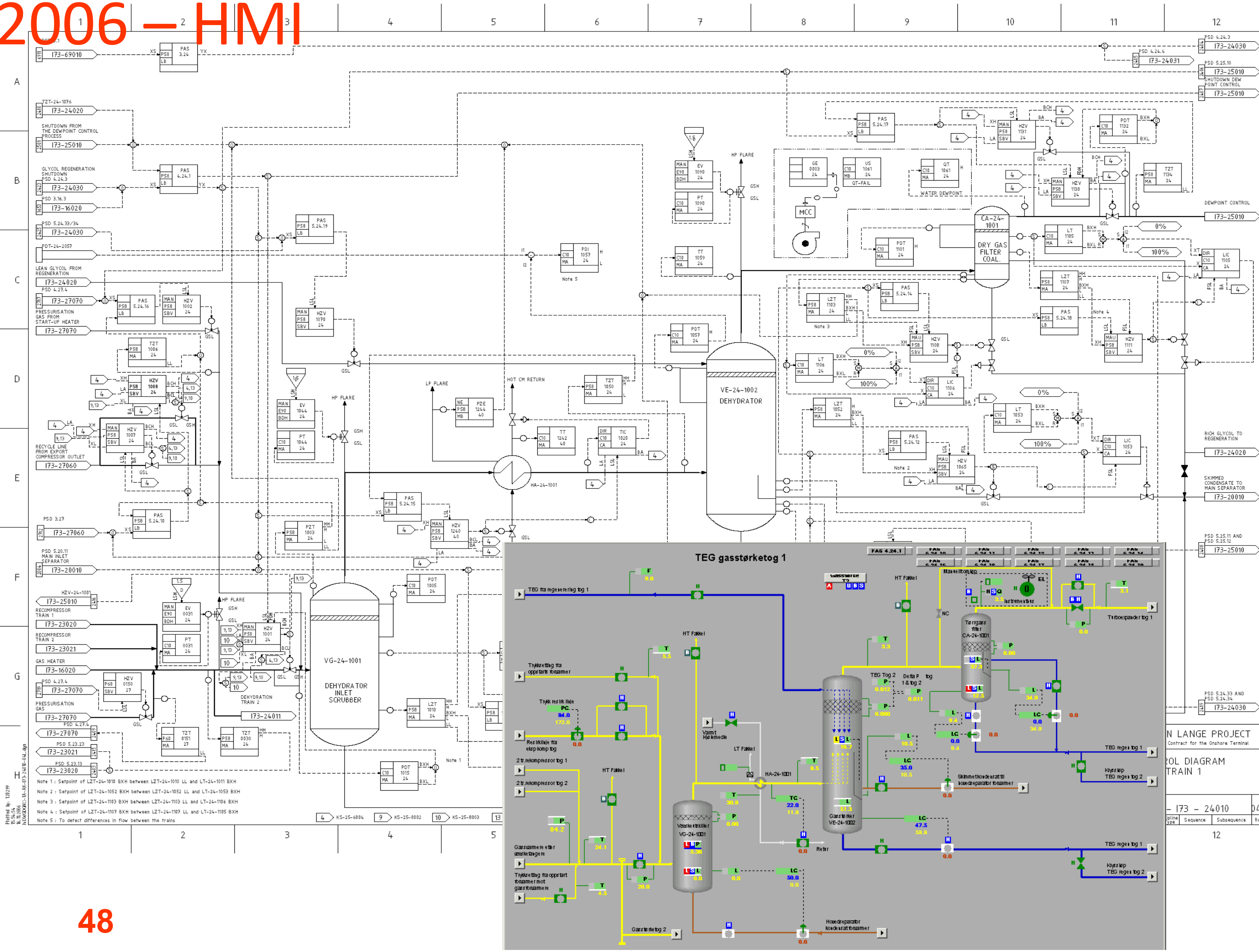
- Minimize DCS SW engineering manhours
- Avoid time spend «yellowlining» at FAT
- Go directly into functional verifaction on Simulator

2006 - SCD

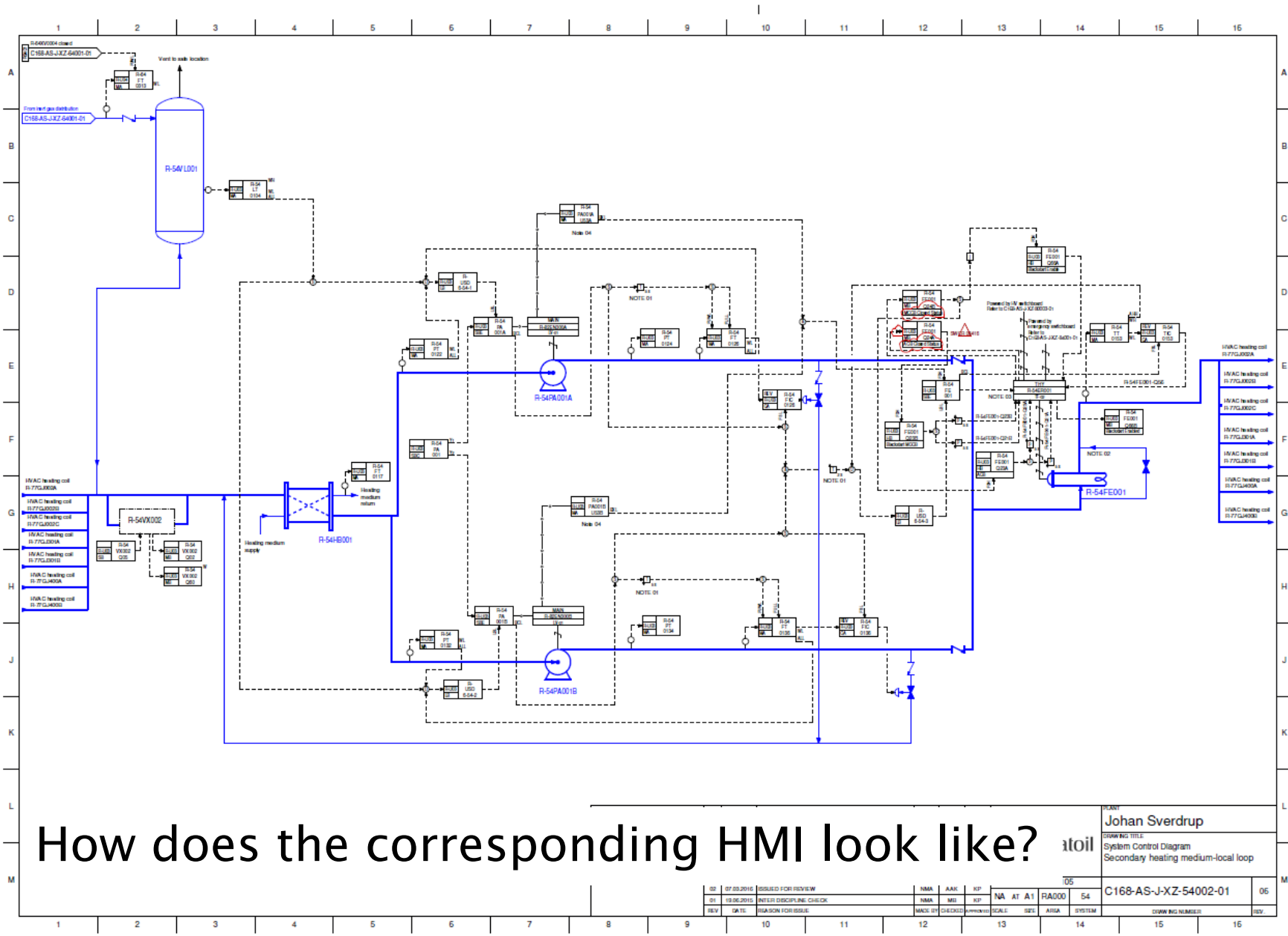


How does the corresponding HMI look like?

2006 – HMI

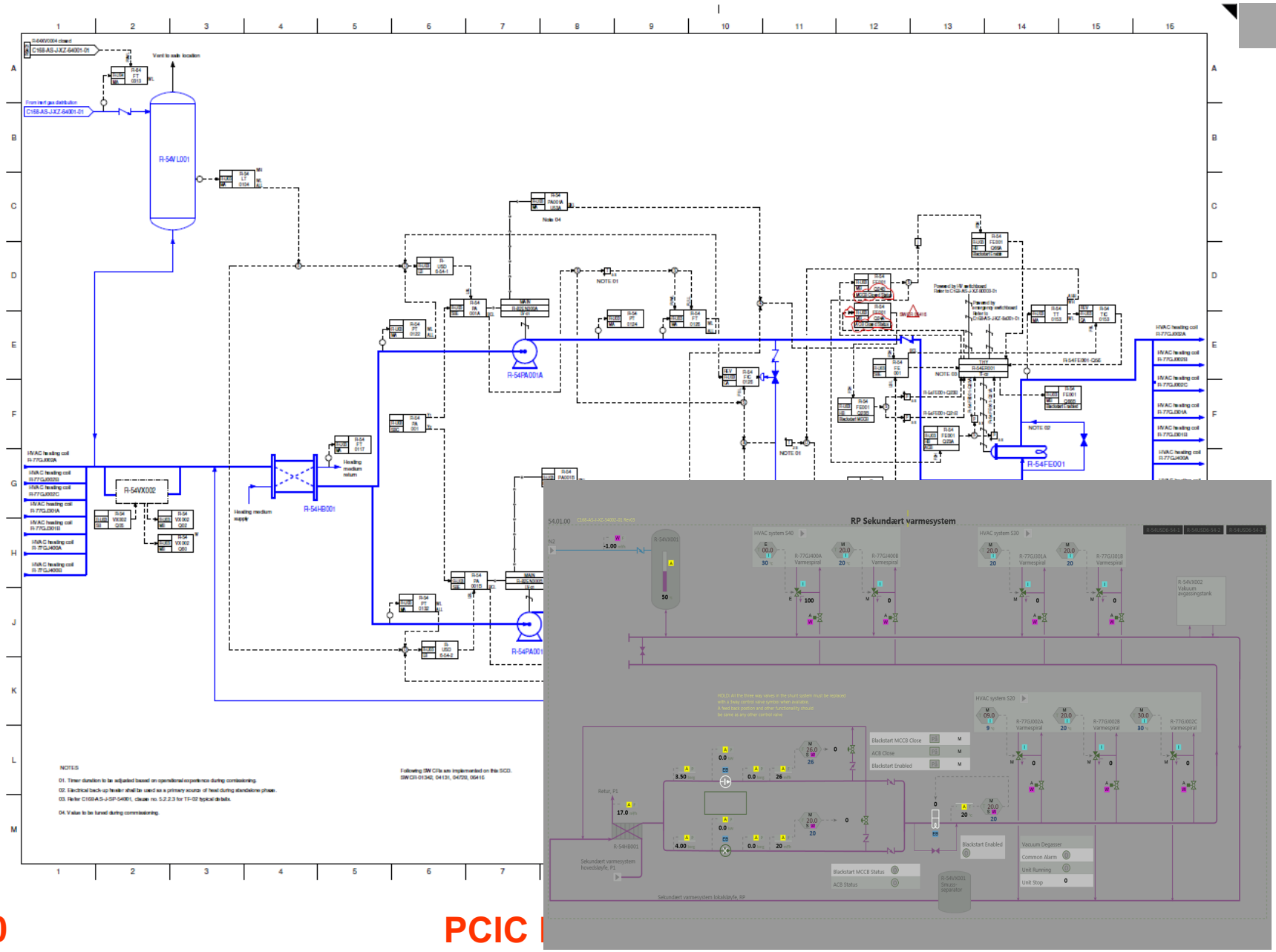

VE-24-1002
DEHYDRATOR
VG-24-1001
DEHYDRATOR INLET SCRUBBER
CA-24-1001
DRY GAS FILTER COAL.
HA-24-1001
HP FLARE
LP FLARE
HOT CM RETURN
MCC
WATER DEWPOINT
DEWPOINT CONTROL
RICH GLYCOL TO REGENERATION
SKIMMED CONDENSATE TO MAIN SEPARATOR
LEAN GLYCOL FROM REGENERATION
GAS HEATER
PRESSURISATION GAS
RECOMPRESSOR TRAIN 1
RECOMPRESSOR TRAIN 2
RECYCLE LINE FROM EXPORT COMPRESSOR OUTLET
Note 1 : Setpoint of LZT-24-1010 BXH between LZT-24-1011 BXH
Note 2 : Setpoint of LZT-24-1052 BXH between LZT-24-1053 BXH
Note 3 : Setpoint of LZT-24-1103 BXH between LZT-24-1106 BXH
Note 4 : Setpoint of LZT-24-1107 BXH between LZT-24-1105 BXH
Note 5 : To detect differences in flow between the trains
N LANGE PROJECT
ROL DIAGRAM
TRAIN 1
TEG gasstørketog 1

2017 - SCD



How does the corresponding HMI look like?

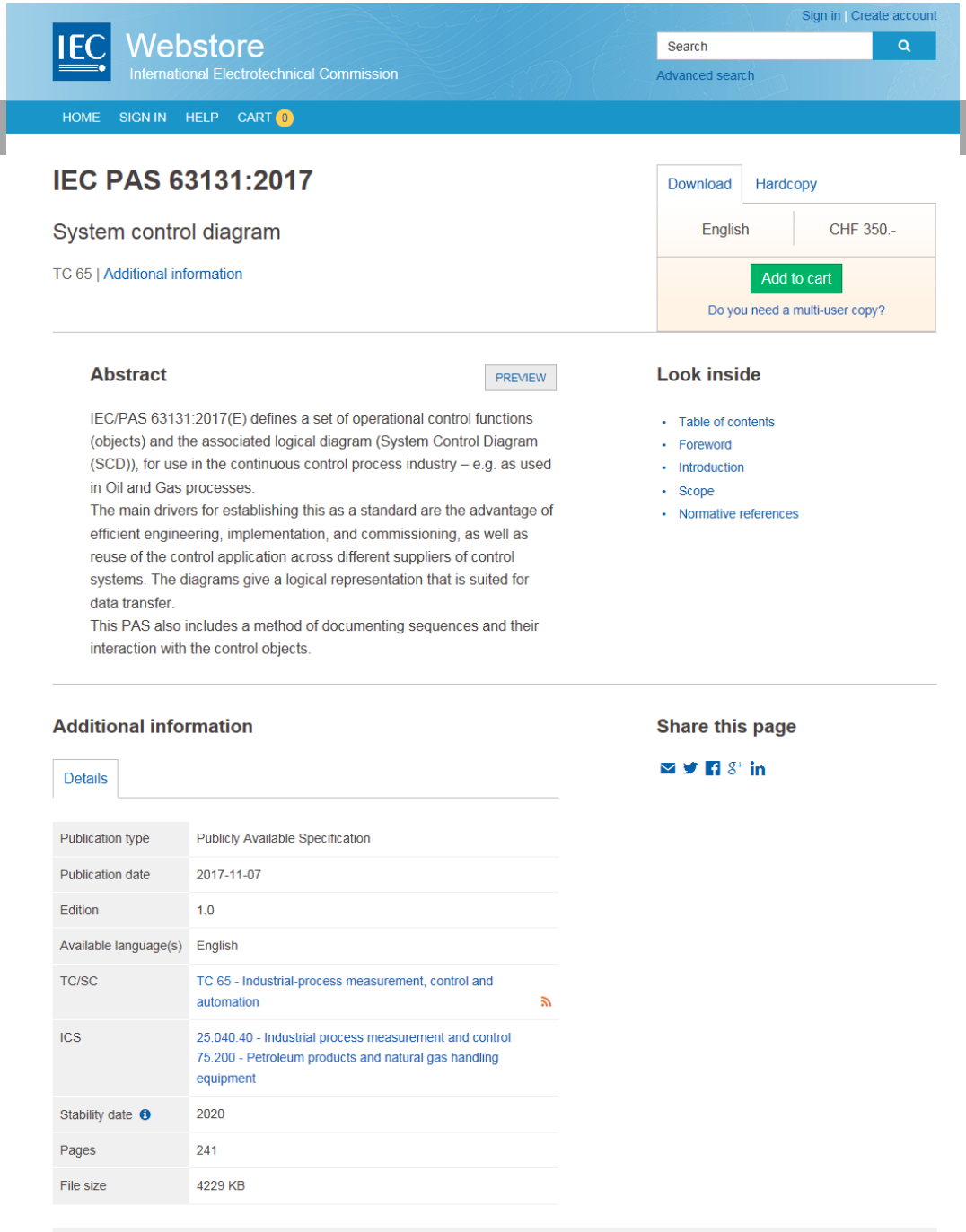
2017 - HMI


R-54V L001
R-54PA001A
R-54PA001
R-54HB001
R-54VX002
R-54FE001
RP Sekundært varmesystem
HVAC system S40
HVAC system S30
HVAC system S20
Blackstart MCCB Close
ACB Close
Blackstart Enabled
Blackstart MCCB Status
ACB Status
Vacuum Degasser
Common Alarm
Unit Running
Unit Stop
Sekundært varmesystem hovedsløjfe, P1
Sekundært varmesystem lokalsløjfe, RP
NOTES
01. Timer duration to be adjusted based on operational experience during commissioning.
02. Electrical back-up heater shall be used as a primary source of heat during standalone phase.
03. Refer C168-AS-J-SP-54001, clause no. 5.2.2.3 for TT-02 typical details.
04. Value to be tuned during commissioning.

PAS IEC 63131 content

IEC PAS 63131

- Next step is to reqruite experts to transfer it into a IEC standard.
  - Adopt IEC terminology
  - Clarify alignment towards existing standards



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System control diagram

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Abstract

PREVIEW

IEC/PAS 63131:2017(E) defines a set of operational control functions (objects) and the associated logical diagram (System Control Diagram (SCD)), for use in the continuous control process industry – e.g. as used in Oil and Gas processes.
The main drivers for establishing this as a standard are the advantage of efficient engineering, implementation, and commissioning, as well as reuse of the control application across different suppliers of control systems. The diagrams give a logical representation that is suited for data transfer.
This PAS also includes a method of documenting sequences and their interaction with the control objects.

Look inside

- Table of contents
- Foreword
- Introduction
- Scope
- Normative references

Additional information

Details

Publication type	Publicly Available Specification
Publication date	2017-11-07
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ICS	25.040.40 - Industrial process measurement and control 75.200 - Petroleum products and natural gas handling equipment
Stability date	2020
Pages	241
File size	4229 KB

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The End