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SAS FUNCTIONAL SPECIFICATION
SYSTEM 42
CHEMICAL INJECTION SYSTEM

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Project no.: 800010 Contract No.: 450 11 89352

Gjøa Semi EPCH

1 RESPONSIBILITY MATRIX FOR THIS DOCUMENT

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
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HVAC[4]	NA					
Electrical[5]	NA					
SAS package vendor[6]	EI171	Arne Einar Årseth	AEÅ			
Package vendor[7]	ER277					
MTO workgroup[8]	NA	Mark Green	MG			
Subcontractor[9]	NA					

Notes:

[1] Instrument discipline accept this document as complete with regards to description of system functionality and operability
[2] Process discipline accept this document as complete with regards to description of system functionality and operability
[3] Safety discipline accept this document as complete with regards to description of system functionality and operability
[4] HVAC discipline accept this document as complete with regards to description of system functionality and operability
[5] Electrical discipline accept this document as complete with regards to description of system functionality and operability
[6] SAS package Vendor accept this document as complete with regards to implementation of defined functionality and operability.
[7] Package vendor accept this document as complete with regards to description of system functionality and operability
[8] MTO Workgroup accept this document as complete with regards to that human factors principles and method have been appropriately considered and integrated.
[9] Subcontractor accept this document as complete with regards to description of system functionality and operability

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2 IMPLEMENTED SEM:

Revision	Implemented SEM references
03	GJOA-00045 New RIO, 87JF762N for mech. package ER277
03	GJOA-01300 Update node for 42FIT4006/4019
03	GJOA-01344 System 21, 42, 87 Data communication Gjøa / Mongstad
03	GJOA-01631 System 87, Signal equations to fit the input unit required by the load calculator.
03	GJOA-02101 Update of actuator logic ER277 Chemical injection
03	GJOA-02119 Density for flow calculation, chemical injection package
04	GJOA-02407 Filter on level and flow transmitters
07	Removed chapter 6.7 VDU pictures since there are lot of changes not shown Updated chapter 6.2.2.19 and 6.2.2.21
08	Removed Internode signal 87NR5424B to initial PSD 5.42.4 from PSD 4.20.2 2nd Stage Separator (node P02) once activated.

3 INTRODUCTION

3.1 Purpose

This document shall be used as:

- Introduction to the relevant parts of SAS functionality
- Reference for clarifications on detailed control and monitoring requirements vs. other disciplines and equipment vendors
- Basis for the relevant parts of:
  - SAS configuration
  - SAS application programming
  - SAS testing
  - Equipment/package testing
  - Commissioning
- Part of the LCI documentation

3.2 Scope

This document covers monitoring and control of system 42, Chemical injection system, by SAS directly, and/or indirectly via separate control systems if relevant. The document shall contain, either directly or by reference:

- Brief description of the process to be controlled (chapter 4)
- Description of the protective functions, including detailed specification of all SAS safety system functionality to be implemented for this system (chapter 5)
- Detailed specification of all non-protective SAS functionality to be implemented in SAS for this system, as well as listings of trends and reports (chapter 6)

Relevant System Control Diagrams (SCDs), control sequence specifications, Cause & Effect charts and VDU pictures are attached.

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

3.3 Abbreviations

Abbreviation	Description
AI	Analog Input
AO	Analog Output
C&E	Cause & Effect
CAP	Critical Action Panel
CCR	Central Control Room
CER	Central Equipment Room
CPU	Central Processing Unit
DI	Digital Input
DO	Digital Output
ECC	Emergency Control Centre
ESD	Emergency ShutDown (system)
ESV	Emergency Safety Valve
F&G	Fire and Gas (system)
FAT	Factory Acceptance Test
FPU	Floating Production Unit
FTC	Field Termination Cabinet
HMI	Human-Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
IE	Instrument Earth
IO	Integrated Operation
IS	Intrinsically Safe
LCI	Life Cycle Information
LDHI	Lav-dose Hydrathemmer
LER	Local Equipment Room
LIR	Local Instrument Room
LQ	Living Quarters
MCC	Motor Control Centre

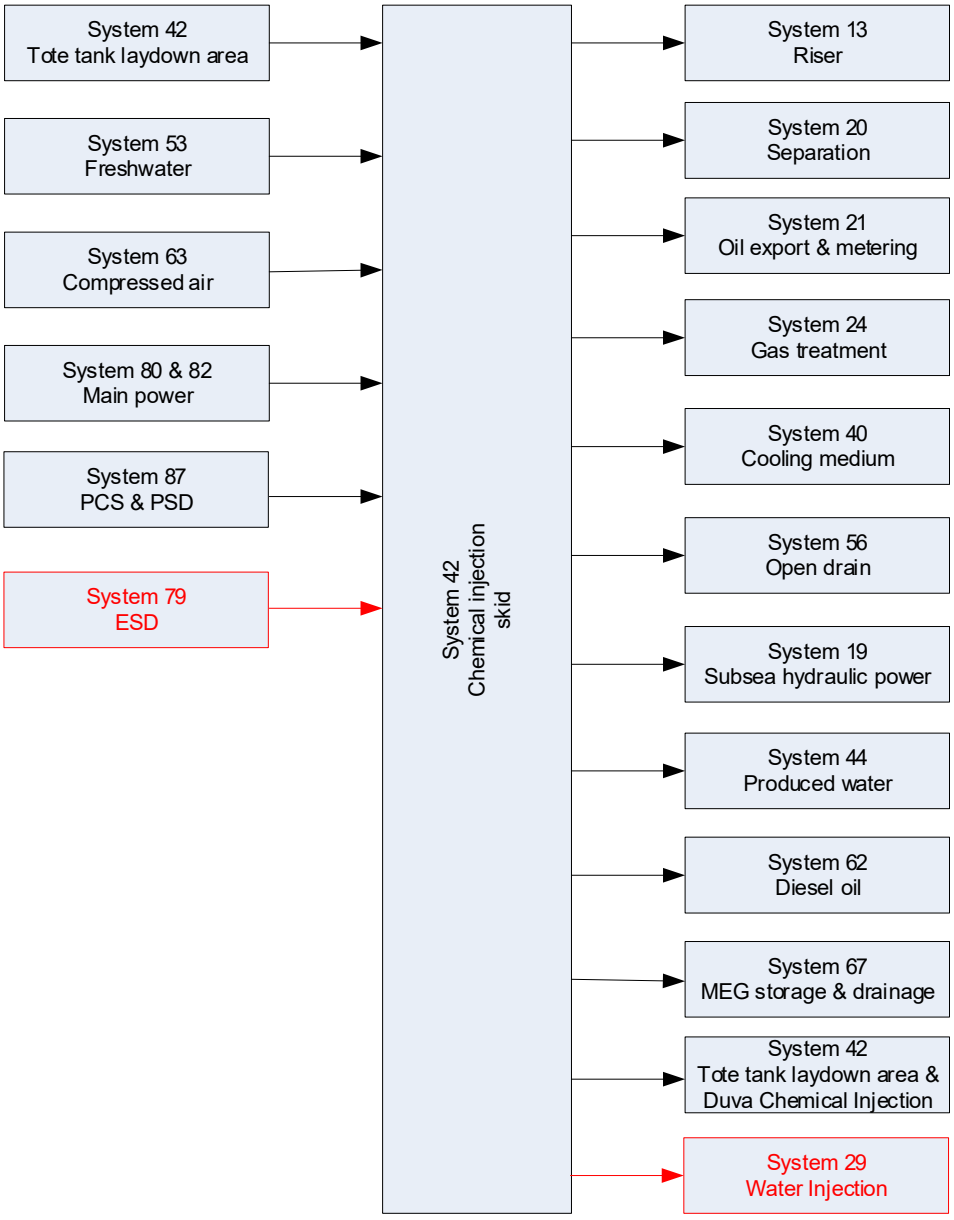
Abbreviation	Description
MTO	Man – Technology – Organisation
PCS	Process Control System
PDCS	Power Distribution Control System
PE	Protective Earth
PFD	Process Flow Diagram
PSD	Process ShutDown (system)
P&ID	Process and Instrumentation Diagram
RIO	Remote Input/Output
SAS	Safety and Automation System
SAT	Safety Analysis Table (Ref. API RP 14C)
SCD	System Control Diagram
SEM	SAS Endrings-Melding
SIL	Safety Integrity Level (Ref. IEC 61508)
USD	Unit ShutDown (Part of PCS)
VDU	Visual Display Unit
XV	PSD shutdown valve

3.4 Definitions

Function	A constellation of causes and the effects or consequences of these causes
System	An integrated structure of functional units that when functioning together are capable of executing specific functions which are not possible by the different functional units in isolation
Interaction	Influence of one system on another system, or vice versa
Interface	Point(s) of interaction between two systems

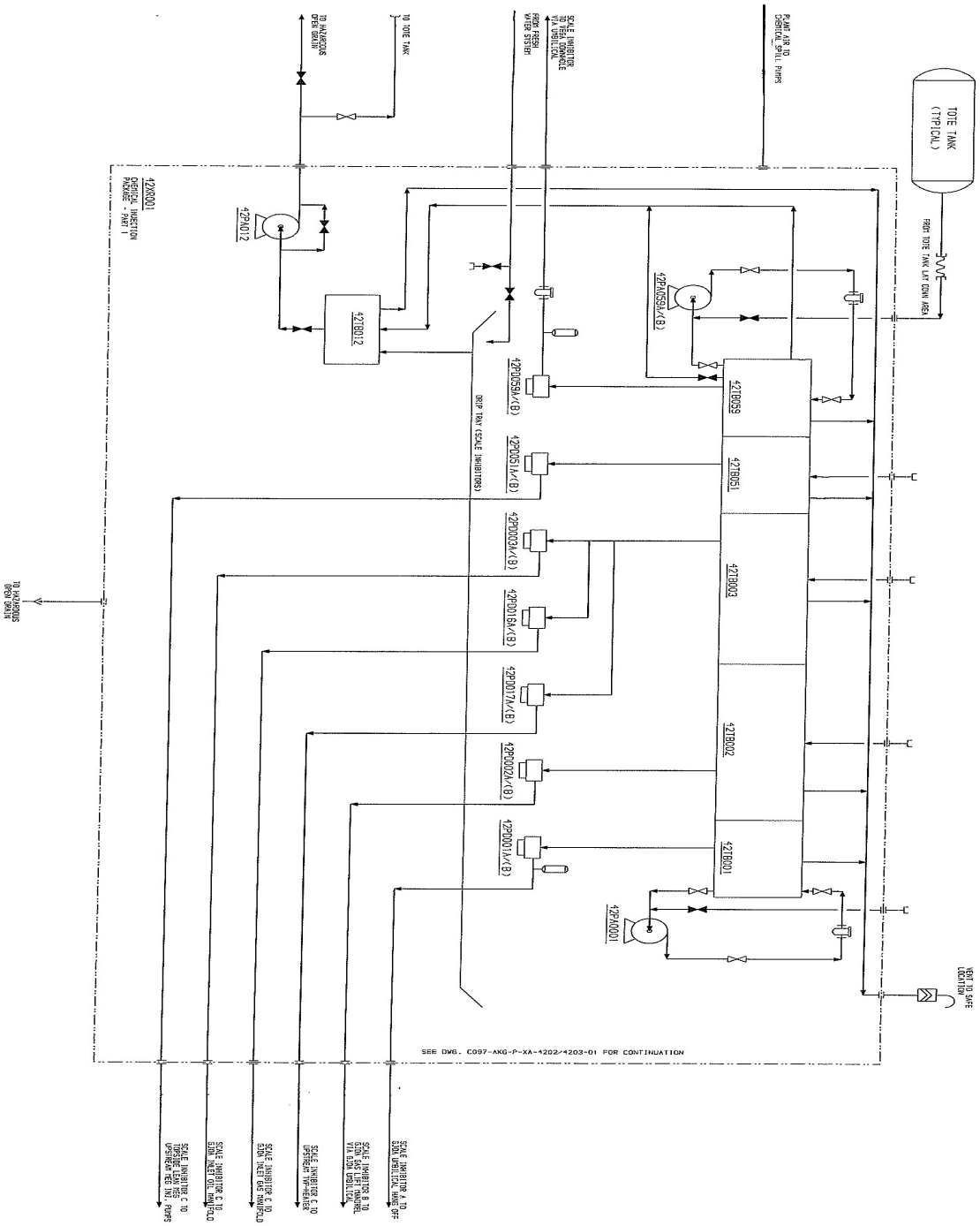
4 PROSESSBESKRIVELSE

4.1 Systemgrensesnitt kjemikalieinjeksjon

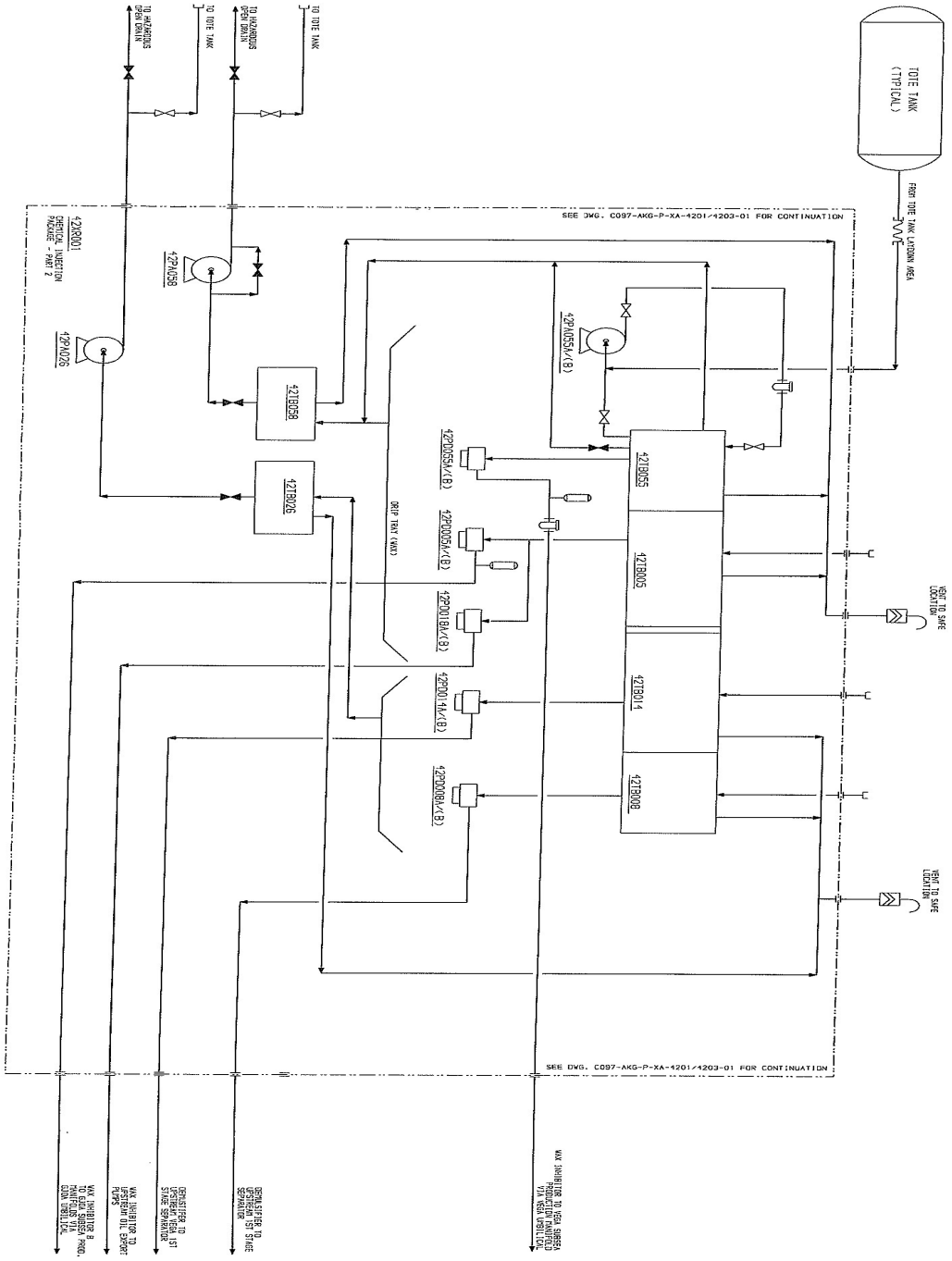


Figur 4.1.1 Systemets grensesnitt

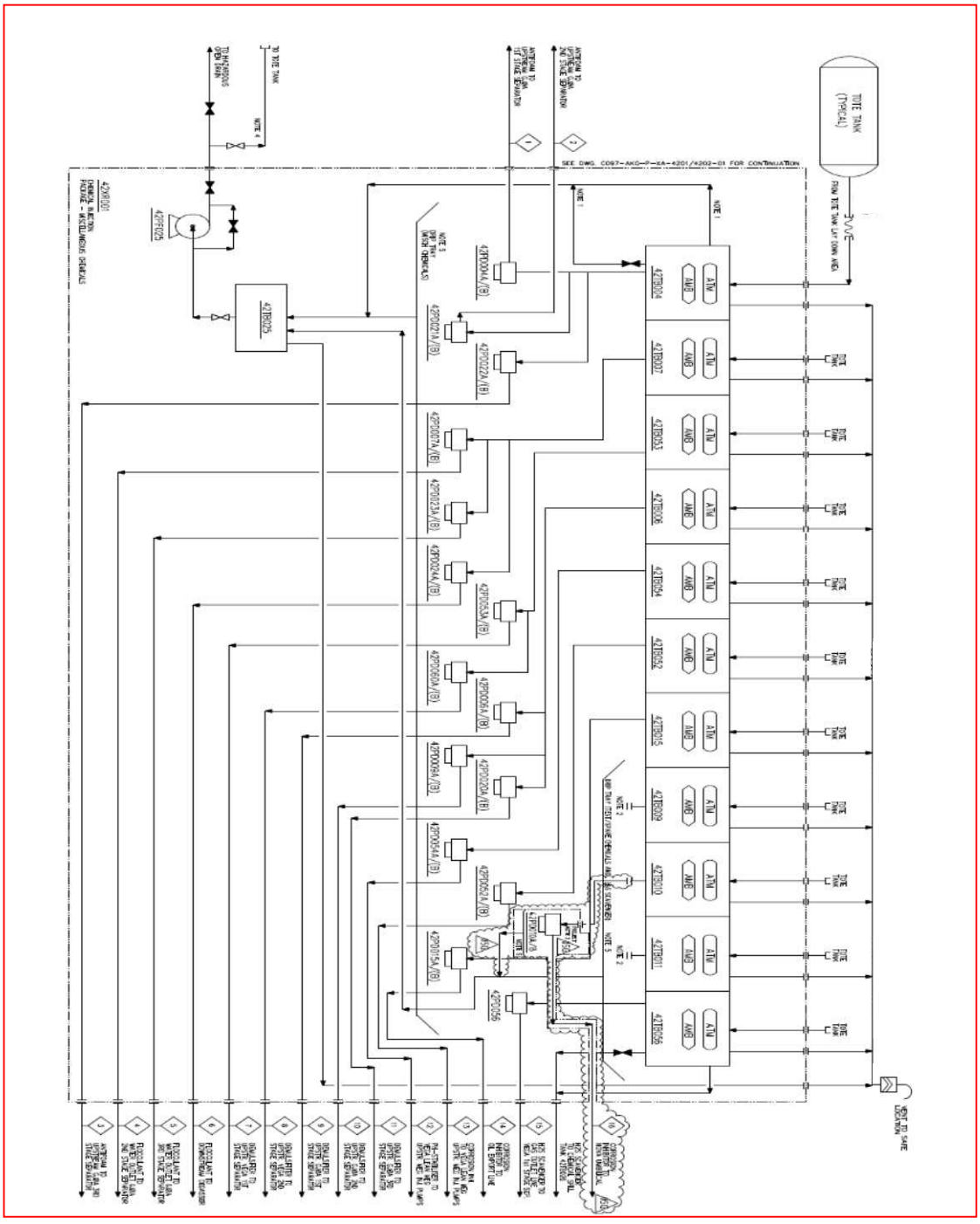
4.2 Systembeskrivelse for kjemikaliepakken



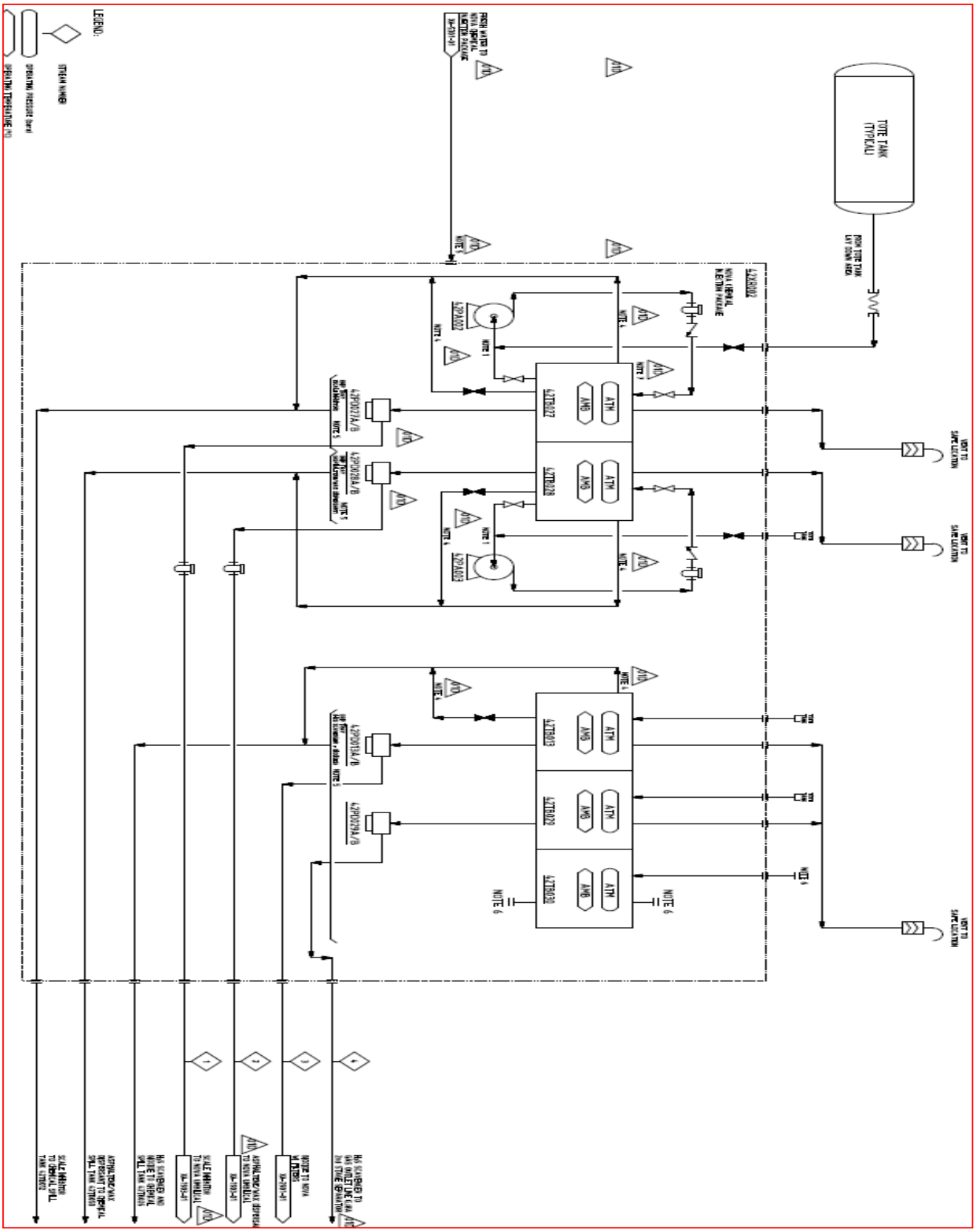
Figur 4.2.1 Kjemikalieinjeksjonspakken – del 1



Figur 4.2.2 Kjemikalieinjeksjonspakken – del 2



Figur 4.2.3 Kjemikalieinjeksjonspakken – del 3



Figur 4.2.4 Kjemikalieinjeksjonspakken Nova – del 4

Kjemikalieinjeksjonspakken er plassert på kjellerdekk i område R141 (EL 42.500) og er felles for både Gjøa og Vega. Hensikten med kjemikalieinjeksjonssystemet er å lagre og injisere kjemikalier i ulike deler av prosessen.

En ny kjemisk injeksjonspakke er installert for Duva felt for kontinuerlig injeksjon av vokshemmer. Vokshemmeren vil forhindre eller redusere voksavsetning når Duva-produksjonsvæsker er under Wax appearance temp (WAT).

Skid er plassert i område P354 og består av vokshemmer lagertank 42TB701 og lav-dose hydrathemmer (LDHI) lagringstank 42TB703. Det er luker i tankveggene mellom to tanker. I tidlig feltliv vil begge kamrene brukes til lagring av vokshemmere.

Ny kjemisk injeksjonspakke består av injeksjonssystemer som håndterer spesifikke kjemikalier som følger:

- Vokshemmer og Lav-dose hydrathemmer (LDHI) til Duva Umbilical - kontinuerlig injeksjon

Kjemikalieinjeksjonspakken for Nova er plassert på Nova Prosess module i område R352 unntatt Nova korrosjonshemmer fordi det er plassert på kjellerdekk i område P141 og brukes tank 42TB010 i eksisterende Kjemikalie skid.

For å unngå blanding av kjemikalier med forskjellige fysikalske egenskaper er disse delt inn i fire grupper:

- Avleiringshemmer
- Oksygenfjerner og biosid
- Vokshemmer
- Forskjellige kjemikalier (emulsjonsbryter, skumdemper, flokkulant, korrosjonshemmer og pH-stabilisator)

Spesielle tiltak er inkludert for å forhindre at kjemikalier i de ulike gruppene kommer i kontakt med hverandre i kjemikaliepakken og i transporttankområdet slik at kjemiske reaksjoner mellom disse ikke kan oppstå.

Følgende kjemikalier injiseres:

Gjøa/Duva, kontinuerlig injeksjon:

- Avleiringshemmer A (til Gjøa produksjonsbrønnene på havbunnen)
- Avleiringshemmer B (til Duva produksjonsbrønnene på havbunnen)
- Avleiringshemmer C (til olje-, gassmanifold og TVP varmer)
- Skumdemper (oppstrøms 1:, 2og 3 trinns separator)
- Vokshemmer (til olje eksport pumpe og manifolder på havbunnen)
- Emulsjonsbryter (oppstrøms separatorene)
- Flokkulant (til produsert vann)
- Korrosjonshemmer (til oljeeksport)
- Duva Vokshemmer og Lav-dose hydrathemmer (LDHI) (gjennom umbilical til subsea Brønnhoder)

Gjøa, etter definerte behov (batch):

- Oksygenfjerner (til kjølemedium kretsen)
- Biosid (til diesel tanker og drenstanker)

Vega, kontinuerlig injeksjon:

- Avleiringshemmer A (til produksjonsbrønnene på havbunnen via MEG systemet)
- Avleiringshemmer B (nedihulls injeksjon)
- Korrosjonshemmer (til produksjonsbrønnene på havbunnen via MEG systemet)
- Emulsjonsbryter (oppstrøms 1, og2 trinns separator)
- pH-stabilisator (til produksjonsbrønnene på havbunnen via MEG systemet)
- Vokshemmer (til manifolder på havbunnen)

Nova, kontinuerlig injeksjon:

- Avleiringshemmer (til oppstrøms 2 trinn separator)
- Korrosjonshemmer (til produksjonslinjene på havbunnen)
- H2S Scavenger (til Gassutløp Gjøa 2 trinn separator)
- Emulsjonsbryter (til oppstrøm 2 trinn separator)

Nova, periodisk injeksjon:

- Skumdemper (til oppstrøm 2 trinn separator)
- Asfalten/Vokshemmer (til produksjonsbrønnene på havbunnen)
- Avleiringshemmer (til oppstrøms 2 trinn separator)

Nova, etter definert behov (batch):

- Biosid (til vanninjeksjon)

Øvrige tanker (fullt instrumentert men uten pumper) for fremtidig bruk:

- Test tank
- Gjøa – Reservetank B
- Vega – Reservetank

Kjemikalieinjeksjonspakken består av 20 lagertanker, 16 for de ulike kjemikaliene, to reservetanker for fremtidige behov samt en testtank for uttesting av nye kjemikalier, Eksisterende reservetank 42TB010 vil bli brukt av Nova og en ny tank 42TB030 bli installert som reserve.

Duva kjemisk injeksjonspakke består av to lagringstanker en for LDHI og en for vokshemmer. LDHI er ikke påkrevd de første årene, så begge disse tankene er koblet sammen med luker og vil brukes til vokshemmende de første årene. LDHI er tilrettelagt for fremtidig injeksjon.

Alle lagertanker er utstyrt med nivåglass som dekker tankens operasjons volum, i tillegg til nivåmåler med signal til kontrollrom. Dessuten finnes seks spilltanker for oppsamling av kjemikaliesøl fra hver av gruppene. Det er 5 nye lagertanker til Nova, som en vil være forbeholdt fremtidige behov.

På grunn av stort krav til renhet (SAE 4059, class 6B-F) til produksjonsbrønnene, er det installert et resirkulasjonssystem for visse kjemikalier. Dette systemet består av en 1x100% resirkulasjonspumpe, som sekvensielt pumper innholdet i lagertanken gjennom et 1x100% filter og tilbake til tank igjen. Dette skal sikre at den nødvendige kvalitet opprettholdes til enhver tid. Disse sløyfene har en trykktransmitter som stopper sirkulasjonspumpen hvis filtret er tett. I sløyfen finnes stusser for spyling av resirkulasjonspumpen. Følgende kjemikalier har denne sløyfe:

- Gjøa – Avleiringshemmer A
- Vega – Avleiringshemmer B
- Vega – Vokshemmer
- Duva - Vokshemmer
- Nova – Avleiringshemmer
- Nova - Asfalten/Vokshemmer

Det er også mulighet til å ta prøver av den resirkulerte strømmen for å sjekke at tilstrekkelig renhetsgrad er oppnådd via egne avtak fra resirkulasjonsstrømmen.

Det er installert separate filtre (2x100%) nedstrøms av hver injeksjonspumpene for kjemikalier som skal injiseres i produksjonsbrønnene. Disse ivaretar at det injiserte kjemikaliet oppfyller kravene som er oppgitt i standard SAE 4059, class 6B-F som foreskrevet,

Transport / midlertidig lagring av kjemikalier foretas ved hjelp av mobile transporttanker (tote tanks). Disse løftes på plass på et dedikert lagringsområde som ligger høyere enn kjemikaliepakken. Fylling av lagertanker fra transporttanker skjer ved hjelp av gravitasjon. Lagertankene er utstyrt med separate fyllelinjer. Transporttanker kobles til fyllelinjene ved hjelp av fleksible slanger med unike koblinger for hver kjemikalie. Hver lagertank er utstyrt med separat ventilasjonslinje med

toppinngang til et samlerør (et for hver gruppe) som er ledet til sikkert område. Overfyllingslinjene og dreneringslinjene går ned til et samlerør som er ledet til respektive spill tank.

Hver lagertank, med unntak av reserve- og testtankene, er koblet til 2x100% injeksjonspumper. For test- og reservetankene er det satt av plass til fremtidige pumper.

Pumpene består av separate pumpehoder med/uten felles motor på følgende måte:

Tabell 4.2.1 Oversikt over tilknyttet pumpehoder mot felles pumpemotor

Pumpehode	Pumpemotor	Motor (kW)
42PD001A/B,42PD002/A/B,42PD003A/B, 42PD016A/B, 42PD017A/B, 42PD051A/B	42PD001A/B-M01	3,0
42PD059A/B	42PD059A/B-M01	0,75
42PD005A/B, 42PD018A/B	42PD005A/B-M01	0,75
42PD055A/B	42PD055A/B-M01	7,5
42PD006A/B,42PD009A/B,42PD020A/B, 42PD053A/B, 42PD060A/B	42PD006A/B-M01	0,55
42PD004A/B, 42PD021A/B, 42PD022A/B	42PD004A/B-M01	0,75
Pumpehode	**Pumpemotor**	**Motor (kW)**
42PD007A/B, 42PD023A/B, 42PD024A/B	42PD007A/B-M01	0,37
42PD008A/B, 42PD014A/B	42PD008A/B-M01	0,55
42PD015A/B, 42PD052A/B, 42PD054A/B	42PD015A/B-M01	0,75
42PD701A/B	42PD701A/B-M01	7,5
42PD010A/B	42PD010A/B-M01	0,75
42PD027A/B	42PD027A/B-M01	1,5
42PD028A/B	42PD028A/B-M01	38
42PD029A/B	42PD029A/B-M01	0,55
42PD013A/B	42PD013A/B-M01	0,75

Pumpemotorene startes og stoppes fra kontrollrommet. Hvis problemer oppstår med et av pumpehodene i drift må man stenge ned alle pumpehoder som er koblet til den drivende motor. Deretter kan man starte opp reservemotoren slik at alle reservepumpehoder kommer i drift. Pumpenes strømningsrater styres ved aktuert justering av slaglengden på pumpene. Kalibreringen skjer med hjelp av mengdemåleren (Coriolis) på utgående linje. For Nova er det innstallert calibration pots oppstrøms injeksjonspumper. Trykket ut av pumpehodet justeres automatisk basert på systemets mottrykk.

Injeksjonspumpene er utstyrt med en intern sirkulasjonssløyfe for å beskytte pumpen. I tillegg finnes en trykktransmitter på pumpehodet som indikerer at et av de to membranene er ødelagt.

For de kjemikalier som skal injiseres til produksjonsbrønnene for Gjøa og Vega er det på utgående linje installert en akkumulator som opprettholder trykket i 5 minutter etter at injeksjonspumpen har stanset. Dette for å forhindre tilbakestrømning av mulige hydrokarboner etter en uforutsett pumpestans. På de systemer som ikke har akkumulator finnes en pulsasjonsdemper på utgående linje. Alle akkumulatorene og pulsasjonsdemperne har nitrogenpute for trykkholding.

Det er i tillegg installert et 2 x 100% høytrykksfilter nedstrøms injeksjonspumpen for å sikre en siste filtrering, til kravene oppgitt i SAE 4059 class 6B-F, av kjemikaliet før det forlater pakken. På linjen nedstrøms av injeksjonspumpene finnes og en sikkerhetsventil for å sikre at systemet ikke overtrykkes. En mengdemåler (Coriolis) som gir aktuell og total injiseringsmengde og en trykktransmitter som gir alarm ved høyt og lavt trykk er og installert på utgående linje.

Trykk-kontroll for kjemikalieinjeksjon til produksjonsbrønnene ivaretas via en lokal ventil for trykk-kontroll (PCV) som må stilles inn manuelt av operatøren basert på forventet behov på produksjonsbrønnene. Overskytende mengde returneres tilbake til den tanken som pumpen suger fra.

Hver av kjemikaliegruppene har et separat spilltrau som dekker respektive gruppes tanker og pumper. Hvert spilltrau er utstyrt med mulighet for ferskvannsspyling. Hvert spilltrau drenerer spilte kjemikalier til en dedikert spilltank i pakkens rammeverk. Separate luftopererte spillpumper pumper væsken i spilltankene til en dedikert tom transporttank i lagringsområdet for destruksjon på land.

Slaglengde Kontroll for Nova

Tabell 4.2.2 Oversikt over tilknyttet pumpekapasitet mot maksimum pumpe slaglengde

Pumpehode	Maks. Slaglengde (mm)	Maks. Pumpekapasitet (l/t)
42PD010A/B	30	10
42PD027A/B	30	19,6
42PD028A/B	60	383
42PD029A/B	20	11,2
42PD013A/B	20	131

Maksimum drifts slaglengde for hver Nova kjemisk injeksjonspumpe vil bli definert basert på følgende formel.

$SL_{set} = SL_{max} \times (C_{req}/C_{max})$

Hvor,

$SL_{set:}$ innstilling av maks. drifts slaglengde (mm)

$SL_{max:}$ maks. slaglengde i henhold til maks. pumpekapasitet (mm)

$C_{req:}$ kapasitet per driftskrav (l/t)

$C_{max:}$ pumpe maks. kapasitet (l/t)

4.3 Dimensjoneringsdata for kjemikaliepakken

Designtemperaturen i pakken/rommet er HVAC-kontrollert 5 – 35 ^{0}C. Alle lagertanker for kjemikalier er atmosfæriske og designet for 0,07 bar overtrykk.

Lagertankenes volum er basert på to ukers forbruk av respektive kjemikalie.

Injeksjonsrater for de forskjellige kjemikaliene er basert på doseringsbehovet definert i design basis, i tillegg til strømningsdata i injeksjonspunktet. Operasjonstrykk, designtrykk og rater vil derfor variere avhengig av service og injeksjonspunkt.

Angitte kjemikalier og doseringsbehov er basert på foreløpig StatoilHydro informasjon. Disse kan komme til å bli noe endret da StatoilHydro leter etter bedre og mer miljøvennlige kjemikalier. Nova kjemikaliepakke 42XR002 er lokalisert utendørs i område R352. Lagertankene er atmosfæriske og har en designtemperatur fra -10°C til 35°C. Injeksjonsrater for de forskjellige kjemikaliene er basert på doseringsbehovet definert i Basis for Design (BfD) Tieback to Gjøa – Nova Execution Phase, SK00-WIN-Z-KC-0008 rev 05M.

Det henvises til kapitel 4.4 for nøkkeldata for utstyr.

Tabell 4.3.1 Oversikt over planlagte kjemikalietyper og doseringsrater for Gjøa

Kjemikalie	Kjemikalietype	Definert doseringsbehov	Injeksjonspunkt	P&ID injeksjonspunkt
Avleiringshemmer A	SCALETREAT 824	0,5 m^3/d	Navlestreng, riser hang-off	C097-AKG-P-XB-1902-01
Avleiringshemmer B	SCALETREAT 8066	20 – 30 ppmv	Gass løft mandrel	C097-AKG-P-XB-1902-01
Avleiringshemmer C	SCALETREAT 852 NW MEG	0,5 m^3/d	Inløp olje manifold	C097-AKG-P-XB-1305-01
			Inløp gass manifold	C097-AKG-P-XB-1302-01
			Oppstrøms TVP varmer	C097-AKG-P-XB-2004-01
Skumdemper	FOAMTREAT 9017	5 – 10 ppmv	Oppstrøms 1st trinn separator	C097-AKG-P-XB-2001-01
			Oppstrøms 2nd trinn separator	C097-AKG-P-XB-2002-01
			Oppstrøms 3rd trinn separator	C097-AKG-P-XB-2005-01
Skumdemper	VAXTREAT 7305	50 – 200 ppmv	Undervann produksjons manifolds	C097-AKG-P-XB-1902-01
			Oppstrøms olje eksport pumps	C097-AKG-P-XB-2102-01
Emulsjonsbryter	PHASETREAT 6190	3 – 10 ppmv	Oppstrøms 1st trinn separator	C097-AKG-P-XB-2001-01
			Oppstrøms 2nd trinn separator	C097-AKG-P-XB-2002-01
			Oppstrøms 3rd trinn separator	C097-AKG-P-XB-2005-01
Flokkulant	FLOCTREAT 7952	5 – 10 ppmv	2nd trinn separator vann utløp	C097-AKG-P-XB-2003-01
			Oppstrøms 3rd trinn separator	C097-AKG-P-XB-4402-01
			Nedstrøms degasser	C097-AKG-P-XB-4404-01
Oksygen fjerner	SCAVTREAT 1005	200 ppmv (batch)	Kjølevæskesystemet	C097-AKG-P-XB-4001-01
Biosid	BIOTREAT 7407	100 l/hr (batch)	Diesel lager tanks	C097-AKG-P-XB-6204-01
			Ikke eksplosjonsfarlig drentanks	C097-AKG-P-XB-5605-01
				C097-AKG-P-XB-5606-01
			Eksplosjonsfarlig dren tanks	C097-AKG-P-XB-5615-01
				C097-AKG-P-XB-5616-01
				C097-AKG-P-XB-5624-01
				C097-AKG-P-XB-5625-01
Korrosjons inhibitor	CORRTREAT 7164	10 l/hr	Olje eksport line	C097-AKG-P-XB-2105-01

Tabell 4.3.2 Oversikt over planlagte kjemikalietyper og doseringsrater for Vega

Kjemikalie	Kjemikalietype	Definert doseringsbehov	Injeksjonspunkt	P&ID injeksjonspunkt
Avleiringshemmer A	SCALETREAT 8199	400 ppmv	Topside tørr MEG	C097-AKG-P-XB-6725-01
Avleiringshemmer B	SCALETREAT 8199	50 ppmv	Nediihull / undervann	C097-AKG-P-XB-1911-01
Korrosjon inhibitor	CORRTREAT 7164	100 ppmv	Topside tørr MEG	C097-AKG-P-XB-6725-01
Emulsjonsbryter	PHASETREAT 6190	1,4 l/hr	Oppstrøms 1st trinn separator	C097-AKG-P-XB-2011-01
	PHASETREAT 6190	1,4 l/hr	Oppstrøms 2nd trinn separator	C097-AKG-P-XB-2013-01
pH stabilisator	TROS 559	44,6 l/hr	Topside tørr MEG	C097-AKG-P-XB-6725-01
Voks inhibitor	WAXTREAT 7305	500 – 2000 ppmv	Undervanns produksjons manifolds	C097-AKG-P-XB-1911-01

Tabell 4.3.3 Oversikt over planlagte kjemikalietyper og doseringsrater for Duva

Kjemikalie	Kjemikalietype	Definert doseringsbehov	Injeksjonspunkt	P&ID injeksjonspunkt
Avleiringshemmer B	DS-1619	8,61 l/hr	Duva Produksjon Brønner	C097-RWP-P-XA-1904-01
Voks Inhibitor	WAXTREAT 16055	126 l/hr	Duva Produksjon Brønner	C097-RWP-P-XA-1904-01
LDHI (Lav dose hydrathemmer)	TBC[Note 1]	8,3 l/hr	Undervanns produksjons manifolds	TBC

Note 1. Lavdose-hydrathemmer er for fremtidig bruk, bare lagertank og spilltank er installert.

Tabell 4.3.4 Oversikt over planlagte kjemikalietyper og doseringsrater for Nova

Kjemikalie	Kjemikalietype	Definert doseringsbehov	Injeksjonspunkt	P&ID injeksjonspunkt
Avleiringshemmer	SCALETREAT 824	0,4 m^3/d	Produksjonsbrønnene på havbunnen	C097-RWP-P-XB-1901-01
Asfalten/ Vokshemmer		8 m^3/d	Produksjonsbrønnene på havbunnen	C097-RWP-P-XB-1901-01
Korrosjonshemmer		0,2 m^3/d	Produksjonslinjene på havbunnen	C097-RWP-P-XB-1901-01
Biosid		2,75 m^3/d (batch)	Oppstrøm Vanninjeksjon filter	C097-RWP-P-XB-2901-01 C097-RWP-P-XB-2902-01
H2S Fjerner		0,21 m^3/d	Gassutløp 2. trinn Separator	C097-AKG-P-XB-2003-01

4.4 Nøkkeldata for utstyr i kjemikaliepakken

Tabell 4.4.1 Nøkkeldata for utstyr for Gjøa

Kjemikalie	Tank Tag no	Tank størrelse m^3	Pump Tag no	Trykk		Injeksjon Mengde	Maks. Kap.	Inj. modus	Nozzle no
				Drift barg	Design Barg	l / hr	l / hr		
Avleiringshemmer A	42TB001	7,0	42PD001A/B	300	345	20,8	26,4	Kont.	N2
Avleiringshemmer B	42TB002	2,9	42PD002A/B	300	345	8,8	8,9	Kont.	N4
Avleiringshemmer C	42TB003	7,0	42PD003A/B	74	250	20,2	26,4	Kont.	N6 *
			42PD016A/B	74	250	0,8	3,03	Kont.	N7
			42PD017A/B	19	32	1,2	3,15	Kont.	N8
Skumdemper	42TB004	5,2	42PD004A/B	64	78	2,9	7,0	Kont.	N26
			42PD021A/B	19	32	6,7	7,0	Kont.	N27 *
			42PD022A/B	1	12	5,8	7,0	Kont.	N28
Voks inhibitor	42TB005	10,0	42PD005A/BC/D	64	249	28,8	30,7	Kont.	N14
			42PD018A/B	8,5	23	29,8	30,8	Kont.	N15
Emulsjonsbryter	42TB006	4,1	42PD006A/B	64	78	2,9	3,73	Kont.	N19
			42PD09A/B	19	32	6,7	6,92	Kont.	N20 *
			42PD020A/B	1	12	5,8	6,92	Kont.	N21
Flokkulant	42TB007	2,2	42PD007A/B	19	32	0 - 6,0	7,28	Kont.	N30
			42PD023A/B	1	12	0,3	1,28	Kont.	N31
			42PD024A/B	3,5	12	6,3	7,45	Kont.	N32
Oksygen fjerner	42TB008	1,0	42PD008A/B	10	20,9	8,9	10,1	Batch	N34
Test tank	42TB009	3,0	Ikke installert						
Reserve tank B	42TB011	3,0	Ikke installert						
Biosid	42TB014	1,0	42PD014A/B	2	13,5	100	112,3	Batch	N36 N37 N38 N39
Korrosjons inhibitor	42TB015	2,0	42PD015A/B	124	185	10,0	11,35	Kont.	N41

* Emulsjonsbryter, skumdemper og avleiringshemmer (topside injeksjon) vil bruke Gjøa utstyr for Nova

Tabell 4.4.2 Nøkkeldata for utstyr for Vega

Kjemikalie	Tank Tag no	Tank størrelse m^3	Pump Tag no	Trykk		Injeksjon mengde	Maks. Kap.	Inj. modus	Nozzle no
				Drift barg	Design barg	l / hr	l / hr		
Avleiringshemmer A	42TB051	0,5	42PD051A/B	5	16	5,4	7,34	Kont.	N10
Korrosjons inhibitor	42TB052	1,0	42PD052A/B	5	16	1,4	3,0	Kont.	N43
Emulsjonsbryter	42TB053	0,6	42PD053A/B	67	78	1,4	2,86	Kont.	N23
			42PD060A/B	24	32	1,4	2,97	Kont.	N24
pH stabilisator	42TB054	15,0	42PD054A/B	5	16	44,6	51,15	Kont.	N45
Voks inhibitor	42TB055	28,0	42PD055A/B	487	689	83,3	90,3	Kont.	N17
Reserve tank	42TB056	3,0	Ikke installert					Kont.	
Avleiringshemmer B	42TB059	1,8	42PD059A/B	487	589	0,2	1,05	Kont.	N12

Tabell 4.4.3 Nøkkeldata for utstyr for spilltanker

Tag nr.	Navn	Driftsvolum m^3
42TB012A/B	Spilltank avleiringshemmer	2,5
42TB025A/B	Spilltank Miscellaneous chemicals	2,5
42TB026	Spilltank Oksygen fjerner & Biosid	2,5
42TB058A/B	Spilltank voks inhibitor	2,5
42TB702	Spilltank voks inhbitor Duva	3,15
42TB704	Spilltank LDHI Duva	0,85

Tabell 4.4.4 Nøkkeldata for utstyr for spillpumper

Tag nr.	Navn	Mengde m^3/hr
42PD012	Spillpumpe for spilltank avleiringshemmer	HOLD
42PD025	Spillpumpe for Miscellaneous chemicals	HOLD
42PD026	Spillpumpe for Oksygen fjerner & Biosid	HOLD
42PD058	Spillpumpe for voks inhibitor	HOLD
42PF701	Spillpumpe for voks inhibitor Duva	2

Tabell 4.4.5 Nøkkeldata for utstyr for resirkulasjonspumper

Tag nr.	Navn	Mengde m^3/hr
42PA001	Avleringshemmer A – Gjøa	2,0
42PA059	Avleiringshemmer B – Vega	2,0
42PA055	Avleiringshemmer – Vega	1,9
42PA701	Voks inhibitor - Duva	1,9
42PA002	Avleiringshemmer - Nova	3,0
42PA003	Asfalten/ Vokshemmer - Nova	3,0

Tabell 4.4.6 Nøkkeldata for skap med sikkerhetsventiler

Tag nr.	Innhold	Sikkerhetsventiler	Dimensjon LxBxH (mm)
42CX001	Avleiringshemmer	42PSV4030/4031/4032/4033/4034/4035/4036	1350x400 x1480
42CX002	Vokshemmer	42PSV4037/4038/4039	725x400x 1480
42CX003	Emulsjonsbryter, skumdemper,	42PSV4040/4041/4042/4043/4044/4045/4046	1350x400 x1480
42CX004	Flokkulant, korrosjonshemmer og pH-stabilisator	42PSV4047/4048/4049/4050/4053/4054/4055	1350x400 x1480
42CX005	Oksygenfjerner og biosid	42PSV4051/4052	625x400x 1480

Tabell 4.4.7 Nøkkeldata for skap med strømningsmålere/filtre/skjermvisere

Tag nr.	Innhold	Strømingsmålere	Injeksjonsfiltre	Dimensjon LxBxH (m m)
42CX006	Avleiringshemmer	42FIT4000/4001	42SX4705/4770/4771/4774	1350x500 x1450
42CX007	Avleiringshemmer	42FIT4002/4003/4004/4005/4006	42SX4705/4721/4722	1350x500 x1450
42CX008	Vokshemmer	42FIT4007/4008/4009	42SX4732/4733/4772/4773	1400x500 x1450
42CX009	Emulsjonsbryter, skumdemper, flokkulant, korrosjonshemmer og pH-stabilisator	42FIT4010/4011/4012/4013/4014/4015/4016/4017/4018/4019/4020/4023/4024/4025	NA	1400x500 x1450
42CX010	Oksygenfjerner og biosid	42FIT4021/4022	NA	1100x500 x1450
42CX011	Skjermviser for emulsjonsbryter, skumdemper, flokkulant, korrosjonshemmer og pH-stabilisator	42FIT4010/4011/4012/4013/4014/4015/4016/4017/4018/4019/4020/4023/4024/4025	NA	HOLD

Tabell 4.4.8 Nøkkeldata for utstyr for Duva

Kjemikalie	Tank Tag no	Tank størrelse m^3	Pump Tag no	Trykk		Injeksjon mengde	Maks. Kap.	Inj. modus	Nozzle no
				Drift barg	Design barg	l / hr	l / hr		
Avleiringshemmer B	42TB002	2,9	42PD002A /B	190	345	8,61	8,9	Kont.	N4

Tabell 4.4.9 Duva Voks inhibitor og LDHI Injeksjon

Kjemikalie	Tank Tag no	Tank størrelse m^3	Pump Tag no	Trykk		Injeksjon mengde	Maks. Kap.	Inj. modus	Nozzle no
				Drift barg	Design barg	l / hr	l / hr		
Voks inhibitor	42TB701	39	42PD701A/B	190	345	126	180	Kont.	N4
LDHI injection	42TB703 (Note 1)	3	-	-	-	- (Note 2)	-	-	-

Note 1: LDHI-tank / rom brukes til voksinhibitor.

Note 2: Mulighet for fremtidig oppkobling av LDHI pumper

Tabell 4.4.10 Nøkkeldata for utstyr for Nova

Kjemikalie	Tank Tag no	Tank størrelse m^3	Pump Tag no	Trykk		Injeksjon mengde	Maks. Kap.	Inj. modus	Nozzle no
				Drift barg	Design Barg (Max)	l / hr	l / hr		
Avleiringshemmer	42TB027	6,73	42PD027A/B	301,5	317	16,7	16,7	Kont.	N17
Asfalten/ Vokshemmer	42TB028	3,61	42PD028A/B	371,5	390	333,3	333,3	Periodisk	N37
Korrosjonshemmer	42TB010	3	42PD010A/B	241,5	254	8,3	8,3	Kont.	N04
Biosid	42TB013	6,01	42PD013A/B	8	**12**	114,6	114,6	Batch	N25
H2S Fjerner	42TB029	3,61	42PD029A/B	22	26	8,8	8,8	Kont.	N21

4.5 System design forutsetninger/operasjonelle betingelser

Mengdemåler på utgående linje brukes for å kalibrere pumpehodene. Aktuert slagkontroll er installert for alle injeksjonspumpene hvilket betyr at operatøren kan utføre denne operasjonen fra kontrollrommet. ”Calibration pot” er ikke installert da den valgte type strømningsmåler (Coriolis) har den nødvendige nøyaktighetsgrad som er påkrevd i forbindelse med kalibrering av pumpene. For Nova, calibration pots er inkludert i oppstrøms injeksjonspumper.

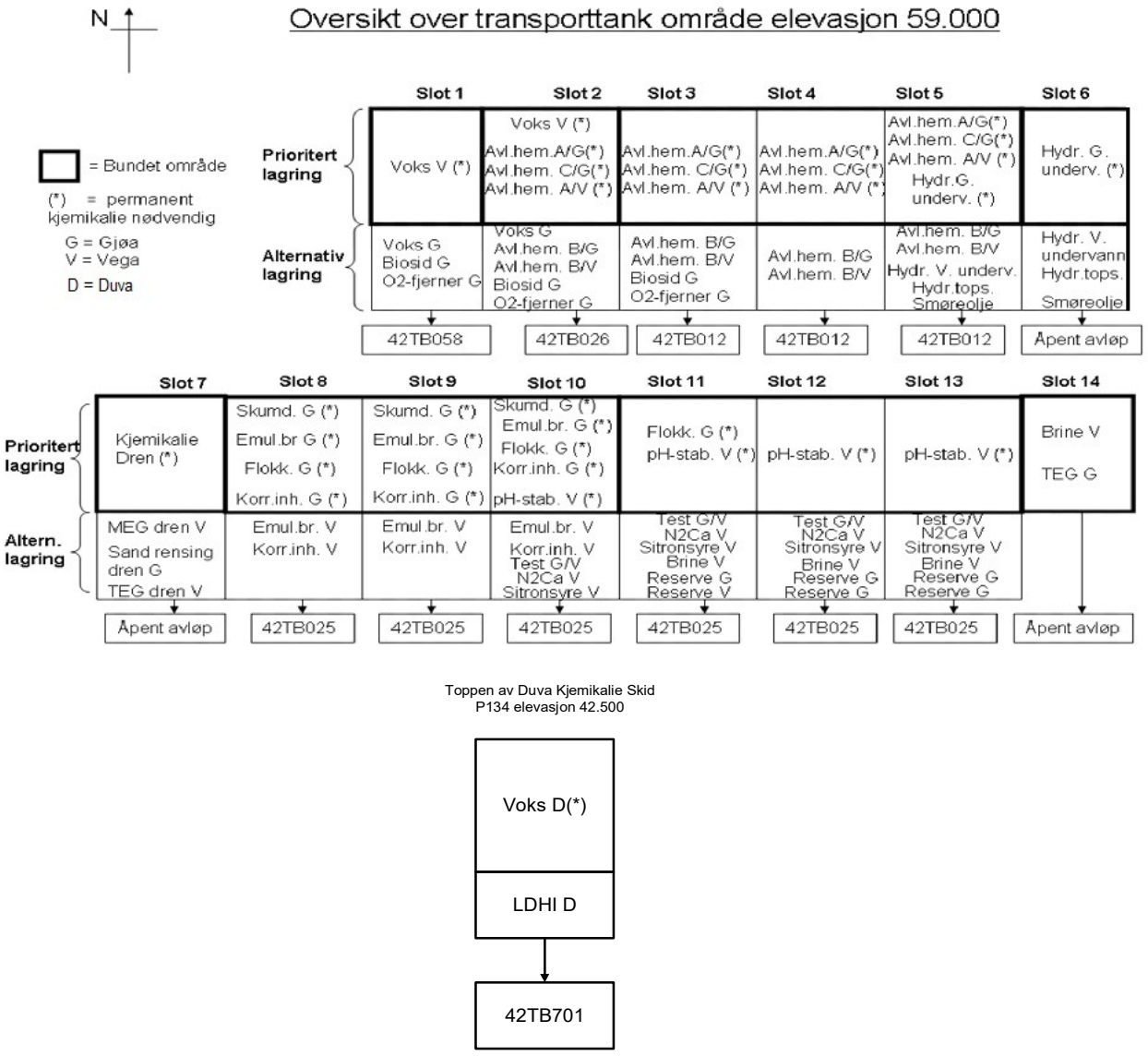
Stroke

Man skal ikke blande kjemikalier sammen med kjemikalier i annen gruppe da de kan reagere med hverandre og danne emulsjoner.

Lagringsområdet er delt inn på følgende måte:

- 12. tanker for kjemikalier
- 1. tanker for hydraulikk- og smøreolje
- 1. tanker for spill

Planlagt lagringsplass(er) for det enkelte kjemikalie på transporttankområdet basert på tilgjengelige slangelengder er vist i figur 4.5.1.



Toppen av Duva Kjemikalie Skid
P134 elevasjon 42.500

Figur 4.5.1 Planlagte lagringsplasser for transporttanker

3. lagertanker er installert i reserve for fremtidig bruk og 1 testtank er installert for å teste ut nye kjemikalier. Disse tankene er instrumentert, men ikke utstyrt med pumper. De har hver sin resirkulasjons stuss som er avblindet. Ventilasjonslinjene fra disse tankene er samlet og koblet til ventilasjonslinjen fra forskjellige kjemikalier. Under disse tankene finnes et separat spilltrau som dreneres til spilltanken for forskjellige kjemikalier.

Plass er reservert for fremtidig installasjon av pumper for reservelagertanker og testtank.

Resirkulasjonspumpenes sekvens startes/stoppes fra kontrollsystemet. Sekvensen kan stilles i enten av eller på posisjon og tidsintervallet kan justeres fra 1 til 24 timer.

Separate spilltanker for hver gruppe med retur til lagringsområdet er installert. Spilltankene har hver sin stuss for fremtidig tilknytting og en separat stuss for ferskvannspyling.

Det er tenkt at spilltankene alltid skal være tomme. Derfor skal en tom lagertank stå permanent plassert i lagringsområdet for å muliggjøre tømning av spilltankene da disse er forholdsvis små sammenlignet med volumet for visse av lagertankene.

Uttesting av nye kjemikalier gjøres ved bruk av den installerte testtank (42TB009). Slange tilkobles utgående linje fra tanken og knyttes inn i mot spylestuss oppstrøms (på sugesiden) av den permanente pumpen som skal teste ut det nye kjemikaliet. Utløpet fra relevant sikkerhetsventil på utløpssiden av pumpen tilkobles med slange til dedikert testtilkobling inne i skapet med retur tilbake til testtanken. For kjemikaler til produksjonsbrønnene på havbunnen , som er utstyrt med egne ventiler for trykk-kontroll, så må slange tilkobles dedikert stuss nedstrøms av ventilene og knyttes opp i mot testtanken (mot nozzle N3).

For kjemikalier som skal injiseres til produksjonsbrønnene er det installert separate ventiler for trykk-kontroll med manuell justering av setpunktet. Disse ventilene er nødvendig siden doseringsventilene (SkoFlo) på produksjonsbrønnene krever stabilt oppstrøms trykk og en minimum tilgjengelig trykkdifferanse over ventilen på omtrent 20 bar for å fungere tilfredstillende. Aktuell injisert mengde til den enkelte brønn kan leses av i kontrollrommet, og dersom denne er for lav i forhold til behovet så må setpunktet endres. Nødvendig setpunkt for disse ventilene må evalueres i hvert enkelt tifelle kontra den injeksjonsmengde som er påkrevd.

Det er ikke installert resirkulasjonspumper for avleringshemmer B eller vokshemmer for injeksjon til produksjonsbrønnene på Gjøa. Dette grunnet at det ikke var plass til å installere dette innenfor kjemikaliepakken, men den nødvendige renhetsgrad (4059, class 6B-F) vil ivaretas av de installerte (2x100%) filtre nedstrøms av injeksjonspumpene. En konsekvens av dette kan bli at filterinnmaten for disse filtrene må byttes oftere enn dersom resirkulasjonspumper var installert.

Vokshemmer resirkulasjonssystem for Duva er basert på en sentrifugalpumpe 42PA701. Trykket over filteret overvåkes ved hjelp av en lokal trykkindikator. Pumpens utløpslinje vil bli ført tilbake til lagringstank 42TB701. Resirkulasjonspumpen sekvens startes/stoppes fra kontrollsystemet (Referanse til **Error! Reference source not found.**).

5 SYSTEM PROTECTION

5.1 ESD protection

According to ESD hierarchy, document no. C097-AKG-J-XL-0001-01, an ESD 2 will initiate PSD 3.0 which shut down the total process including the Nova Scale inhibitor, Asphaltene/ Wax dispersant and corrosion inhibitor system.

The following ESD valves for system 42 are defined and will be closed upon ESD 2:

42ESV0080 Nova Scale Inhibitor ESV

42ESV0081 Nova Asphaltene and Wax Dispersant ESV

42ESV0082 Nova Corrosion Inhibitor A ESV

42ESV0083 Nova Corrosion Inhibitor B ESV

42ESV0084 Nova Spare Chemical Injection ESV (No logic to be installed at this stage)

The following electrical heaters will be electrically isolated upon ESD 2 as ignition source control:

- 42FE001 – Heater H2S scavenger storage tank
- 42FE002 – Heater wax/asphaltene dispersant storage tank
- 42FE003 – Heater biocide storage tank.
- 42FE004 – Heater scale inhibitor storage tank

Heater 42FE005 in spare storage tank shall not be used before tanks is set into service. When spare tank is set into operation it shall be electrically isolated upon ESD2 as ignition source control.

Refer to SCD's: C097-RWP-J-XL-1903-01 / 4217-01 / 4219-01 / 4220-01 / 4221-01 / 4222-01 / 4223-01

5.2 PSD protection

Duva Wax Inhibitor System

Refer SCD: C097-RWP-J-XL-4224-01, C&E: C097-RWP-J-XR-8701-140 and PSD hierarchy level 5: C097-RWP-J-XL-0004-06.

The new level PSD 5.42.5 for Duva wax inhibitor is activated from PSD3.1 through internode signal and the following actions are activated

- High-High level on 42LST7014 closes valve 42XV7004 and trips pump 42PA701
- Low-Low level on 42LST7014 trips pump 42PD701A/B and heater 42FE701
- High-High and Low-Low pressure on 42PSIT7022/7023 trips pump 42PD701A/B
- High-High temperature on 42TST7015 trips heater 42FE701

According to the PSD hierarchy, document no. C097-AKG-J-XL-0004-06, a PSD 3.1 will initiate PSD 5.42.1, 5.42.2, 5.42.3, and 5.42.4 which will close the corresponding ESV valves (42ESV0080, 42ESV0081, 42ESV0082 and 42ESV0083) and trip the respective pumps (42PD027A, 42PD027B, 42PD028A, 42PD028B, 42PD029A, 42PD029B, 42PD0210A, and 42PD010B)

The following PSD levels are defined for the Chemical injection system:

- PSD 5.42.1: Nova Scale Inhibitor Injection
- PSD 5.42.2: Nova Asphaltene / Wax dispersant

- PSD 5.42.3: Nova Corrosion Inhibitor
- PSD 5.42.4: Nova H2S Scavenger

Nova Scale Inhibitor:

Refer to SCD documents: C097-RWP-J-XL-4219-01 and C097-RWP-J-XL-1903-01

PSD 5.42.1 will initiate trip of Scale Inhibitor injection pumps 42PD027A & 42PD027B and close the ESV valve 42ESV0080.

The following conditions shall initiate PSD 5.42.1:

- Internode signal 87NR5421A which received from PSD 3.1 Total Production Shutdown (node P02) once activated.
- Pressure Safety Transmitter 42PST0045 shall initiate PSD level 5.42.1 once pressure setting High-High and Low-Low is reached.

Nova Asphaltene/Wax Dispersant:

Refer to SCD documents: C097-RWP-J-XL-4220-01 and C097-RWP-J-XL-1903-01

PSD 5.42.2 will initiate trip of Asphaltene/Wax Dispersant injection pumps 42PD028A & 42PD028B and close the ESV valve 42ESV0081.

The following conditions shall initiate PSD 5.42.2:

- Internode signal 87NR5422A which received from PSD 3.1 Total Production Shutdown (node P02) once activated.
- Pressure Safety Transmitter 42PST0064 shall initiate PSD level 5.42.2 once pressure setting High-High and Low-Low is reached.

Nova Corrosion Inhibitor:

Refer to SCD documents: C097-RWP-J-XL-4221-01 and C097-RWP-J-XL-1903-01

PSD 5.42.3 will initiate trip of Corrosion Inhibitor injection pumps 42PD010A & 42PD010B and close the ESV valves 42ESV0082 & 42ESV0083.

The following conditions shall initiate PSD 5.42.3:

- Internode signal 87NR5423A which received from PSD 3.1 Total Production Shutdown (node P02) once activated.
- Pressure Safety Transmitter 42PST0052 shall initiate PSD level 5.42.3 once pressure setting High-High and Low-Low is reached.
- Activation of PSD 5.401 Nova Production Flowlines A & B.

Nova H2S Scavenger:

Refer to SCD documents: C097-RWP-J-XL-4223-01

PSD 5.42.4 will initiate trip of Corrosion Inhibitor injection pumps 42PD029A & 42PD029B.

The following conditions shall initiate PSD 5.42.4:

- Internode signal 87NR5424A which received from PSD 3.1 Total Production Shutdown (node P02) once activated.
- 08

5.3 PCS/USD protection

Scale inhibitor A/B/C Gjøa and A Vega:

Refer SCD: C097-AKG-J-XL-4201 Scale Inhibitor A Gjøa.

SCD: C097-AKG-J-XL-4202 Scale Inhibitor B Gjøa.

SCD: C097-AKG-J-XL-4203 Scale Inhibitor C Gjøa.

SCD: C097-AKG-J-XL-4204 Scale Inhibitor A Vega.

PCS protective functions initiate trips of scale inhibitor A/B/C Gjøa and A Vega injection pumps and scale inhibitor A circulation pump.

The scale Inhibitor A/B/C Gjøa & A Vega pumps have PSV's as overpressure protection.

Two USD levels are defined for scale inhibitor system:

1. PAS6001 for scale inhibitor A/B/C and A Vega (42PD001A/002A/003A/016A/017A/051A)
2. PAS6002 for scale inhibitor A/B/C and A Vega (42PD001B/002B/003B/016B/017B/051B)

The following conditions will initiate a PAS6001 shutdown:

- Low-low level (42LT4060) and Low-low pressure (42PIT4094) and high-high temperature (42TT4180) in the scale inhibitor A Gjøa storage tank shall trip the injection pumps (42PD001A-M01).
- Low-low level (42LT4061) and Low-low pressure (42PIT4097) and high-high temperature (42TT4182) in the Scale inhibitor B Gjøa shall trip the injection pumps (42PD001A-M01).
- Low-low level (42LT4062) and Low-low pressure (42PIT4100/4103/4106) and high-high temperature (42TT4184/4186/4188) in the Scale inhibitor C Gjøa shall trip the injection pumps (42PD001A-M01).
- Low-low level (42LT4063) and Low-low pressure (42PIT4109) and high-high temperature (42TT4190) in the Scale inhibitor A Vega shall trip the injection pumps (42PD001A-M01).

The following conditions will initiate a PAS6002 shutdown:

- Low-low level (42LT4060) and Low-low pressure (42PIT4094) and high-high temperature (42TT4181) in the scale inhibitor A Gjøa storage tank shall trip the injection pumps (42PD001B-M01).
- Low-low level (42LT4061) and Low-low pressure (42PIT4097) and high-high temperature (42TT4183) in the Scale inhibitor B Gjøa shall trip the injection pumps (42PD001B-M01).
- Low-low level (42LT4062) and Low-low pressure (42PIT4100/4103/4106) and high-high temperature (42TT4185/4187/4189) in the Scale inhibitor C Gjøa shall trip the injection pumps 42PD001B-M01.
- Low-low level (42LT4063) and Low-low pressure (42PIT4109) and high-high temperature (42TT4191) in the Scale inhibitor A Vega shall trip the injection pumps (42PD001B-M01).

The following conditions will initiate a PCS shutdown:

- Low-low and High-high pressure (42PT4091) shall trip the circulation pump (42PA001-M01)
- Low level (42LT4060) in the scale inhibitor storage tank A shall trip the circulation pump (42PA001A-M01).

Note: The pumps (42PD001A/002A/003A/016A/017A/051A) have the same motor 42PD001A-M01 and also the pumps (42PD001B/002B/003B/016B/017B/051B) have the same motor 42PD001B-M01.

The scale Inhibitor B Vega:

Refer SCD: C097-AKG-J-XL-4205 Scale Inhibitor B Vega.

PCS protective functions initiate trips of scale inhibitor B Vega injection pumps.

The scale inhibitor B Vega pumps have PSV's as overpressure protection.

Two USD levels are defined for scale inhibitor system:

1. PAS6003 for scale inhibitor B Vega 42PD059A
2. PAS6004 for scale inhibitor B Vega 42PD059B

The following conditions will initiate a PAS6003 shutdown:

- Low-low level (42LT4064) in the scale inhibitor B Vega storage tank shall trip the injection pump (42PD059A-M01).
- Low-low pressure (42PIT4114) in the discharge line of scale inhibitor B Vega shall trip the injection pump (42PD059A-M01).
- High-high temperature (42TT4192) shall trip the injection pump 42PD059A.

The following conditions will initiate a PAS6004 shutdown:

- Low-low level (42LT4064) in the scale inhibitor B Vega storage tank shall trip the injection pump (42PD059B-M01).
- Low-low pressure (42PIT4114) in the discharge line of scale inhibitor B Vega shall trip the injection pump (42PD059B-M01).
- High-high temperature (42TT4193) shall trip the injection pump 42PD059B.

The following conditions will initiate a PCS shutdown:

- Low-low and High-high pressure (42PT4111) shall trip the circulation pump 42PA059.
- Low level (42LT4064) in the scale inhibitor B storage tank shall trip the circulation pump 42PA059.

Wax inhibitor Gjøa:

Refer SCD: C097-AKG-J-XL-4206 Wax Inhibitor Gjøa.

PCS protective functions initiate trips of wax inhibitor Gjøa injection pumps.

The wax inhibitor Gjøa pumps have PSV's as overpressure protection.

Two USD levels are defined for wax inhibitor system:

1. PAS6005 for wax inhibitor Gjøa (42PD005A-M01)
2. PAS6006 for wax inhibitor Gjøa (42PD005B-M01)

The following conditions will initiate a PAS6005 shutdown:

- Low-low level (42LT4066) in the wax inhibitor Gjøa storage tank shall trip the injection pump (42PD005A-M01).
- Low-low pressure (42PIT4117 and 42PIT4120) in the discharge line of wax inhibitor Gjøa shall trip the injection pump (42PD005A-M01).
- High-high temperature (42TT4194, 42TT4196 and 42TT4245) shall trip the injection pump 42PD005A-M01

The following conditions will initiate a PAS6006 shutdown:

- Low-low level (42LT4066) in the wax inhibitor Gjøa storage tank shall trip the injection pump (42PD005B-M01).
- Low-low pressure (42PIT4117 and 42PIT4120) in the discharge line of wax inhibitor Gjøa shall trip the injection pump (42PD005B-M01).
- High-high temperature (42TT4195, 42TT4197 and 42TT4246) shall trip the injection pump 42PD005B-M01

Note: The pumps 42PD005A/018A have the same motor 42PD005A-M01 and also the pumps 42PD005B/018B have the same motor 42PD005B-M01.

Wax inhibitor Vega:

Refer SCD: C097-AKG-J-XL-4207 Wax Inhibitor Vega.

PCS protective functions initiates trips of wax inhibitor Vega injection pumps.

The wax inhibitor Vega pumps have PSV's as overpressure protection.

Two USD levels are defined for scale inhibitor system:

1. PAS6007 for wax inhibitor Vega (42PD055A-M01)
2. PAS6008 for wax inhibitor Vega (42PD055B-M01)

The following conditions will initiate a PAS6007 shutdown:

- Low-low level (42LT4068) in the wax inhibitor Vega storage tank shall trip the injection pump (42PD055A-M01).
- Low-low pressure (42PIT4125) in the discharge line of wax inhibitor Vega shall trip the injection pump (42PD055A-M01).
- High-high temperature (42TT4198) shall trip the injection pump 42PD055A.

The following conditions will initiate a PAS6008 shutdown:

- Low-low level (42LT4068) in the wax inhibitor Vega storage tank shall trip the injection pump (42PD055B-M01).
- Low-low pressure (42PIT4124) in the discharge line of wax inhibitor Vega shall trip the injection pump (42PD055B-M01).
- High-high temperature (42TT4199) shall trip the injection pump (42PD055B-M01).

The following conditions will initiate a PCS shutdown:

- Low-low and High-high pressure (42PT4122) shall trip the circulation pump 42PA055.
- Low level (42LT4068) in the wax inhibitor Vega storage tank shall trip the circulation pump 42PA055.

Duva Wax inhibitor:

Refer SCD: C097-RWP-J-XL-4224 Wax Inhibitor Duva.

PCS protective functions initiate trips of Wax inhibitor Duva injection pumps.

The wax inhibitor Duva pumps have PSV's as overpressure protection.

Three USD levels are defined for Duva Wax inhibitor system:

1. PAS6034 for Wax inhibitor Duva (42PA701-M01).
2. PAS6035 for Wax inhibitor Duva (42PD701A-M01).
3. PAS6036 for Wax inhibitor Duva (42PD701B-M01).

The following conditions will initiate a PAS6034 shutdown:

- High-High and High pressure on (42PIT7012) and shall trip the circulation pump (42PA701-M01).
- Low-Low and Low pressure on (42PIT7012) and shall trip the circulation pump (42PA701-M01).
- Low level on (42LT7013) shall trip circulation pump (42PA701-M01).

The following conditions will initiate a PAS6035 shutdown:

- Close of oil flow line valve (13ESV1201) shall trip injection pump (42PD701A-M01).
- High pressure on (42PT7018) shall trip injection pump (42PD701A-M01).

The following conditions will initiate a PAS6036 shutdown:

- Close of flowline valve (13ESV1201) shall trip injection pump (42PD701B-M01).
- High pressure on (42PT7019) shall trip injection pump (42PD701B-M01).

Note: The injection pumps 42PD701A/B have individual motors. 42PA701 is a centrifugal pump.

Demulsifier Gjøa and Vega:

Refer SCD: C097-AKG-J-XL-4208 Demulsifier Gjøa

SCD: C097-AKG-J-XL-4209 Demulsifier Vega

PCS protective functions initiate trips of demulsifier Gjøa and Vega injection pumps.

The demulsifier Gjøa and Vega pumps have PSV's as overpressure protection.

Two USD levels are defined for demulsifier system:

1. PAS6009 for wax inhibitor Vega (42PD006A-M01)
2. PAS6010 for wax inhibitor Vega (42PD006B-M01)

The following conditions will initiate a PAS6009 shutdown:

- Low-low level (42LT4069) in the demulsifier Gjøa storage tank and low-low level (42LT4070) in the wax inhibitor Vega storage tank shall trip the injection pump (42PD006A-M01).
- Low-low pressure (42PIT4128, 42PIT4131 and 42PIT4134) in the discharge line of demulsifier Gjøa and low-low pressure (42PIT4137 and 42PIT4140) in the discharge line of demulsifier Vega shall trip the injection pump (42PD006A-M01).
- High-high temperature (42TT4200, 42TT4202 and 42TT4204 (Gjøa) and 42TT4206 and 42TT4208 (Vega)) shall trip the injection pump 42PD006A-M01.

The following conditions will initiate a PAS6010 shutdown:

- Low-low level (42LT4069) in the demulsifier Gjøa storage tank and low-low level (42LT4070) in the demulsifier Vega storage tank shall trip the injection pump (42PD006B-M01).

- Low-low pressure (42PIT4128, 42PIT4131 and 42PIT4134) in the discharge line of demulsifier Gjøa and low-low pressure (42PIT4137 and 42PIT4140) in the discharge line of demulsifier Vega shall trip the injection pump (42PD006B-M01).
- High-high temperature (42TT4201, 42TT4203 and 42TT4205 (Gjøa) and 42TT4207 and 42TT4209 (Vega)) shall trip the injection pump 42PD006B-M01.

Note: The pumps 42PD006A/009A/020A/053A/060A have the same motor 42PD006A-M01 and also the pumps 42PD006B/009B/020B/053B/060B have the same motor 42PD006B-M01.

Antifoam Gjøa:

Refer SCD: C097-AKG-J-XL-4210 Antifoam Gjøa

PCS protective functions initiate trips of antifoam Gjøa injection pumps.

The pumps have PSV's as overpressure protection.

Two USD levels are defined for demulsifier system:

1. PAS6011 for antifoam Gjøa (42PD004A-M01)
2. PAS6012 for antifoam Gjøa (42PD004B-M01)

The following conditions will initiate a PAS6011 shutdown:

- Low-low level (42LT4071) in the antifoam Gjøa storage tank shall trip the injection pump (42PD004A-M01).
- Low-low pressure (42PIT4143, 42PIT4146 and 42PIT4149) in the discharge line of antifoam Gjøa shall trip the injection pump (42PD004A-M01).
- High-high temperature (42TT4210, 42TT4212 and 42TT4214) shall trip the antifoam pump 42PD004A-M01.

The following conditions will initiate a PAS6012 shutdown:

- Low-low level (42LT4071) in the antifoam Gjøa storage tank shall trip the injection pump (42PD004B-M01).
- Low-low pressure (42PIT4143, 42PIT4146 and 42PIT4149) in the discharge line of antifoam Gjøa shall trip the injection pump (42PD004B-M01).
- High-high temperature (42TT4211, 42TT4213 and 42TT4215) shall trip the antifoam pump 42PD004B-M01.

Note: The pumps 42PD004A/021A/022A have the same motor 42PD004A-M01 and also the pumps 42PD004B/021B/022B have the same motor 42PD006B-M01.

Flocculant Gjøa:

Refer SCD: C097-AKG-J-XL-4211 Antifoam Gjøa

PCS protective functions initiate trips of flocculant Gjøa injection pumps.

The pumps have PSV's as overpressure protection.

Two USD levels are defined for demulsifier system:

3. PAS6013 for antifoam Gjøa (42PD007A-M01)
4. PAS6014 for antifoam Gjøa (42PD007B-M01)

The following conditions will initiate a PAS6013 shutdown:

- Low-low level (42LT4072) in the flocculant Gjøa storage tank shall trip the injection pump (42PD007A-M01).
- Low-low pressure (42PIT4152, 42PIT4155 and 42PIT4158) in the discharge line of flocculant Gjøa shall trip the injection pumps (42PD007A-M01).
- High-high temperature (42TT4216, 42TT4218 and 42TT4220) shall trip the flocculant pumps 42PD007A-M01.

The following conditions will initiate a PAS6014 shutdown:

- Low-low level (42LT4072) in the flocculant Gjøa storage tank shall trip the injection pump (42PD007B-M01).
- Low-low pressure (42PIT4152, 42PIT4155 and 42PIT4158) in the discharge line of flocculant Gjøa shall trip the injection pumps (42PD007B-M01).
- High-high temperature (42TT4217, 42TT4219 and 42TT4221) shall trip the flocculant pumps 42PD007B-M01.

Note: The pumps 42PD007A/023A/024A have the same motor 42PD007A-M01 and also the pumps 42PD007B/023B/024B have the same motor 42PD007B-M01.

Oxygen scavenger and Biocide Gjøa:

Refer SCD: C097-AKG-J-XL-4212 Oxygen scavenger Gjøa

SCD: C097-AKG-J-XL-4213 Biocide Vega

PCS protective functions initiate trips of oxygen scavenger and biocide injection pumps.

The oxygen scavenger and biocide pumps have PSV's as overpressure protection.

Two USD levels are defined for oxygen scavenger and biocide system:

1. PAS6015 for wax inhibitor Vega (42PD008A-M01)
2. PAS6016 for wax inhibitor Vega (42PD008B-M01)

The following conditions will initiate a PAS6015 shutdown:

- Low-low level (42LT4073) in the oxygen scavenger storage tank and low-low level (42LT4074) in the biocide storage tank shall trip the injection pump (42PD008A-M01).
- Low-low pressure (42PIT4161) in the discharge line of oxygen scavenger and low-low pressure (42PIT4164) in the discharge line of biocide shall trip the injection pump (42PD008A-M01).
- High-high temperature (42TT4222 and 42TT4224) shall trip the injection pump 42PD008A-M01.

The following conditions will initiate a PAS6016 shutdown:

- Low-low level (42LT4073) in the oxygen scavenger storage tank and low-low level (42LT4074) in the biocide storage tank shall trip the injection pump (42PD008B-M01).
- Low-low pressure (42PIT4161) in the discharge line of oxygen scavenger and low-low pressure (42PIT4164) in the discharge line of biocide shall trip the injection pump (42PD008B-M01).
- High-high temperature (42TT4223 and 42TT4225) shall trip the injection pump 42PD008B-M01.

Note: The pumps 42PD008A/014A have the same motor 42PD008A-M01 and also the pumps 42PD008B/014B have the same motor 42PD008B-M01

Corrosion inhibitor Gjøa and Vega and pH stabiliser Vega:

Refer SCD: C097-AKG-J-XL-4214 Corrosion inhibitor Gjøa

SCD: C097-AKG-J-XL-4215 Corrosion inhibitor Vega

SCD: C097-AKG-J-XL-4216 pH stabiliser Vega

PCS protective functions initiate trips of corrosion inhibitor and pH stabiliser injection pumps.

The corrosion inhibitor and pH stabiliser injection pumps have PSV's as overpressure protection.

Two USD levels are defined for corrosion inhibitor Gjøa and Vega and pH stabiliser system:

1. PAS6017 for corrosion inhibitor/pH stabiliser (42PD015A-M01)
2. PAS6018 for corrosion inhibitor/pH stabiliser (42PD015B-M01)

The following conditions will initiate a PAS6017 shutdown:

- Low-low level (42LT4075) in the corrosion inhibitor Gjøa storage tank and low-low level (42LT4076) in the corrosion inhibitor Vega storage tank and the low-low level (42LT4077) in the pH stabiliser Vega storage tank shall trip the injection pump (42PD015A-M01).
- Low-low pressure (42PIT4167) in the discharge line of corrosion inhibitor Gjøa and low-low pressure (42PIT4170) in the discharge line of corrosion inhibitor Vega and low-low pressure (42PIT4173) in the discharge line of pH stabiliser Vega shall trip the injection pump (42PD015A-M01).
- High-high temperature (42TT4226, 42TT4228 and 42TT4230) shall trip the injection pumps 42PD015A-M01.

The following conditions will initiate a PAS6018 shutdown:

- Low-low level (42LT4075) in the corrosion inhibitor Gjøa storage tank and low-low level (42LT4076) in the corrosion inhibitor Vega storage tank and the low-low level (42LT4077) in the pH stabiliser Vega storage tank shall trip the injection pump (42PD015B-M01).
- Low-low pressure (42PIT4167) in the discharge line of corrosion inhibitor Gjøa and low-low pressure (42PIT4170) in the discharge line of corrosion inhibitor Vega and low-low pressure (42PIT4173) in the discharge line of pH stabiliser Vega shall trip the injection pump (42PD015B-M01).
- High-high temperature (42TT4227, 42TT4229 and 42TT4231) shall trip the injection pumps 42PD015B-M01.

Note: The pumps 42PD015A/052A/054A have the same motor 42PD015A-M01 and also the pumps 42PD015B/052B/054B have the same motor 42PD015B-M01

Scale inhibitor Nova:

Refer SCD: C097-RWP-J-XL-4219-01 Nova Scale Inhibitor

PCS protective functions initiate trips of scale inhibitor Nova injection pumps.

The scale inhibitor Nova pumps have PSV's as an overpressure protection.

Three USD levels are defined for Nova scale inhibitor system:

1. PAS2029 for Nova scale inhibitor injection pump 42PD027A
2. PAS6030 for Nova scale inhibitor injection pump 42PD027B
3. PAS6031 for Nova scale inhibitor recirculation pump 42PA002

The following conditions will initiate a PAS2029 shutdown:

- Low-low level (42LT0037) in the Nova scale inhibitor storage tank shall trip the injection pump (42PD027A-M01).
- High pressure (42PT0038) in the pump diaphragm upon rupture, shall trip the injection pump (42PD027A-M01).

The following conditions will initiate a PAS2030 shutdown:

- Low-low level (42LT0037) in the Nova scale inhibitor storage tank shall trip the injection pump (42PD027B-M01).
- High pressure (42PT0040) in the pump diaphragm upon rupture, shall trip the injection pump (42PD027B-M01).

The following conditions will initiate a PAS6031 shutdown:

- In the Nova scale inhibitor storage tank, low-low level (42LT0037) shall trip the injection pump (42PD027A) and high-high level (42LT0037) shall trip the recirculation pump (42PA002))
- Low-low and high-high pressure (42PT0035) of Nova recirculation line shall trip the recirculation pump (42PA002).

Asphaltene/Wax inhibitor Nova:

Refer SCD: C097-RWP-J-XL-4220-01 Nova Asphaltene/ Wax Inhibitor

PCS protective functions initiate trips of asphaltene/wax Nova injection pumps.

The asphaltene/wax Nova pumps have PSV's as an overpressure protection.

Three USD levels are defined for Nova asphaltene/wax system:

1. PAS6021 for Nova asphaltene/wax injection pump 42PD028A
2. PAS6022 for Nova asphaltene/wax injection pump 42PD028B
3. PAS6032 for Nova asphaltene/wax recirculation pump 42PA003

The following conditions will initiate a PAS6021 shutdown:

- Low-low level (42LT0058) in the Nova asphaltene/wax dispersant storage tank shall trip the injection pump (42PD028A-M01).
- High-high pressure (42PT0060) in the pump diaphragm upon rupture, shall trip the injection pump (42PD028A-M01).

The following conditions will initiate a PAS6022 shutdown:

- Low-low level (42LT0058) in the Nova asphaltene/wax dispersant storage tank shall trip the injection pump (42PD028B-M01).
- High-high pressure (42PT0062) in the pump diaphragm upon rupture, shall trip the injection pump (42PD028B-M01).

The following conditions will initiate a PAS6032 shutdown:

- High-high level (42LT0058) in the Nova asphaltene/wax dispersant storage tank shall trip the recirculation pump (42PA003).
- Low-low and high-high pressure (42PT0057) of Nova recirculation line shall trip the recirculation pump (42PA003).

Corrosion inhibitor Nova:

Refer SCD: C097-RWP-J-XL-4221-01 Nova Corrosion inhibitor

PCS protective functions initiate trips of corrosion inhibitor injection pumps.

The corrosion inhibitor injection pumps have PSV's as overpressure protection.

Two USD levels are defined for Nova corrosion inhibitor system:

1. PAS6023 for Nova corrosion inhibitor injection pump 42PD010A
2. PAS6024 for Nova corrosion inhibitor injection pump 42PD010B

The following conditions will initiate a PAS6023 shutdown:

- Low-low level (42LT4079) in the Nova corrosion inhibitor storage tank shall trip the injection pump (42PD010A-M01).
- High-high pressure (42PT0048) in the pump diaphragm upon rupture, shall trip the injection pump (42PD010A-M01).

The following conditions will initiate a PAS6024 shutdown:

- Low-low level (42LT4079) in the Nova corrosion inhibitor storage tank shall trip the injection pump (42PD010B-M01).
- High-high pressure (42PT0050) in the pump diaphragm upon rupture, shall trip the injection pump (42PD010B-M01).

Biocide Nova:

Refer SCD: C097-RWP-J-XL-4222 Nova Biocide

PCS protective functions initiate trips of Biocide Nova injection pumps.

The Biocide Nova pumps have PSV's as an overpressure protection.

Two USD levels are defined for Biocide system:

1. PAS6025 for Nova Biocide injection pump 42PD013A
2. PAS6026 for Nova Biocide injection pump 42PD013B

The following conditions will initiate a PAS6025 shutdown:

- Low-low level (42LT0001) in the Nova Biocide storage tank shall trip the injection pump (42PD013A-M01).
- Low-low pressure (42PT0006) in the discharge line of Nova Biocide shall trip the injection pump (42PD013A-M01).
- High-high pressure (42PT0006) in the discharge line of Nova Biocide shall trip the injection pump (42PD013A-M01).
- High-high pressure (42PT0002) in the pump diaphragm upon rupture, shall trip the injection pump (42PD013A-M01).
- Nova Water Injection Pump (29PA001) status not running shall trip the injection pump (42PD013A-M01).

The following conditions will initiate a PAS6026 shutdown:

- Low-low level (42LT0001) in the Nova Biocide storage tank shall trip the injection pump (42PD013B-M01).
- Low-low pressure (42PT0006) in the discharge line of Nova Biocide shall trip the injection pump (42PD013B-M01).
- High-high pressure (42PT0006) in the discharge line of Nova Biocide shall trip the injection pump (42PD013B-M01).
- High-high pressure (42PT0004) in the pump diaphragm upon rupture, shall trip the injection pump (42PD013B-M01).
- Nova Water Injection Pump (29PA001) status not running shall trip the injection pump (42PD013B-M01).

H2S Scavenger Nova:

Refer SCD: C097-RWP-J-XL-4223 Nova H2S Scavenger

PCS protective functions initiate trips of Nova H2S scavenger injection pumps.

The Nova H2S scavenger pumps have PSV's as an overpressure protection.

Two USD levels are defined for H2S system:

1. PAS6027 for Nova H2S Scavenger injection pump 42PD029A
2. PAS6028 for Nova H2S Scavenger injection pump 42PD029B

The following conditions will initiate a PAS6027 shutdown:

- Low-low level (42LT0009) in the Nova H2S Scavenger storage tank shall trip the injection pump (42PD029A-M01).
- Low-low pressure (42PT0014) in the discharge line of Nova H2S Scavenger shall trip the injection pump (42PD029A-M01).
- High-high pressure (42PT0014) in the discharge line of Nova H2S Scavenger shall trip the injection pump (42PD029A-M01).
- High pressure (42PT0010) in the pump diaphragm upon rupture, shall trip the injection pump (42PD029A-M01).

The following conditions will initiate a PAS6028 shutdown:

- Low-low level (42LT0009) in the Nova H2S Scavenger storage tank shall trip the injection pump (42PD029B-M01).
- Low-low pressure (42PT0014) in the discharge line of Nova H2S scavenger shall trip the injection pump (42PD029B-M01).
- High-high pressure (42PT0014) in the discharge line of Nova H2S scavenger shall trip the injection pump (42PD029B-M01).
- High pressure (42PT0012) in the pump diaphragm upon rupture, shall trip the injection pump (42PD029B-M01).

5.4 F&G protection

Chemical Injection skid located in P141A. Its protected by deluge/AFFFs (71SU001), Aquatic film forming foam system common with fire zone P100A. This system has fire and gas detection as IR point gas detection, optical smoke detector and IR flame detector.

Nova Chemical Injection Package is in R352. It's protected by deluge/AFFFs (71SU001/2/3/4), Aquatic film forming foam system common with fire zone P300A. This system has fire and gas detection as IR point gas detection, IR flame detector manual call Points, manual release (Deluge) and ESD Push button.

5.4.1 Duva Chemical Injection F&G Protection

Chemical Injection skid for Duva located in lower deck P134/P234. It is protected by deluge which is connected to existing system (71US0002-1). This system has fire detection as IR point gas detection, open path gas detector and IR flame detector.

6 CONTROL AND MONITORING

6.1 Control objectives

The objective for controlling this system is to maintain stable process conditions and minimise the number of shutdowns.

6.1.1 Special control objectives

The main objective of the system 42 is to:

- Ensure stable operation of chemical injection systems such that pressure and level specification are met.
- Maximise plant life time by avoiding stress situation and optimising control response to transient situations.
- Ensure trouble free start-up and shutdown of the process
- Minimise downtime by careful attention to control of process disturbances

6.1.2 Fulfilment of special control objectives

All pumps are manually controlled from SAS such that the operator can control the chemicals injection system together with local actions from field.

- Scale inhibitor A system is for subsea distribution. To fulfil the requirement of cleanness of the scale inhibitor A chemical, recirculation pumps upstream storage tank is installed. The pumps are automatic controlled from SAS (sequence)
- Spill tank pumps are totally manual operated from field.

6.2 Control and monitoring structures

6.2.1 Overview

SCDs:

C097-AKG-J-XL-4201-01 Scale Inhibitor A (42PD001A/B) Gjøa.

C097-AKG-J-XL-4202-01 Scale Inhibitor B (42PD002A/B) Gjøa.

C097-AKG-J-XL-4203-01 Scale Inhibitor C (42PD003A/B, 016A/B, 017A/B, 051A/B) Gjøa.

C097-AKG-J-XL-4204-01 Scale Inhibitor A (42PD051A/B) Vega.

C097-AKG-J-XL-4205-01 Scale Inhibitor B (42PD059A/B) Vega.

C097-AKG-J-XL-4206-01 Wax Inhibitor 42PD005A/B,018A/B Gjøa.

C097-AKG-J-XL-4207-01 Wax Inhibitor 42PD055A/B Vega.

C097-AKG-J-XL-4208-01 Demulsifier 42PD006A/B,009A/B,020A/B Gjøa.

C097-AKG-J-XL-4209-01 Demulsifier 42PD053A/B,060A/BVega.

C097-AKG-J-XL-4210-01 Antifoam 42PD004A/B Vega.

C097-AKG-J-XL-4211-01 Flocculant 42PD007A/B Gjøa.

C097-AKG-J-XL-4212-01 Oxygen scavenger 42PD008A/B Gjøa.

C097-AKG-J-XL-4213-01 Biocide 42PD014A/B Gjøa.

C097-AKG-J-XL-4214-01 Corrosion Inhibitor 42PD015A/B Gjøa.

C097-AKG-J-XL-4215-01 Corrosion Inhibitor 42PD052A/B Vega.

C097-AKG-J-XL-4216-01 pH stabiliser 42PD054A/B Vega.

C097-AKG-J-XL-4217-01 Spare & Test tanks Gjøa/Vega.

C097-AKG-J-XL-4218-01 Chemical spill tanks Gjøa/Vega.

C097-RWP-J-XL-4219-01 Scale inhibitor Nova

C097-RWP-J-XL-4220-01 Asphaltene/Wax Nova

C097-RWP-J-XL-4221-01 Corrosion inhibitor Nova

C097-RWP-J-XL-4222-01 Biocide Nova

C097-RWP-J-XL-4223-01 H2S Scavenger Nova

C097-RWP-J-XL-4224-01 Duva Wax Inhibitor.

C097-RWP-J-XL-4225-01 Chemical Injection System.

C097-RWP-J-XL-1903-01 Nova Umbilical Interface

C097-RWP-J-XL-4230-01 Scale Inhibitor C to Nova

6.2.2 Control Structures

6.2.2.1 Control of Scale Inhibitor A/B/C Gjøa & Scale Inhibitor A Vega

Refer to SCDs: C097-AKG-J-XL-4201-01/4202-01/4203-01/4204-01

The injection pumps 42PD001A /002A /003A /016A /017A /051A and 42PD001B /002B /003B /016B /017B /051B are 2x100% pumps (duty/standby). Duty/standby selection is done through manual operation.

These pumps (42PD001A/002A/003A/016A/017A/051A) are driven by the same electrical motor 42PD001A-M01.

These pumps (42PD001B/002B/003B/016B/017B/051B) are driven by the same electrical motor 42PD001B-M01.

Circulation pump 42PA001 is driven by electrical motor 42PA001-M01. The operator initiates the start sequence (42HIS3027) for 42PA001. The circulation pump shall then start and stop automatically. The operator shall set the time between start and stop of circulation. Refer to chapter 6.2.5.

42FQI4000A shall calculate the total flow for scale inhibitor A Gjøa. Reset of 42FQI4000A shall be manually done by the operator (42HIS3001).

42FQI4000B shall calculate the total flow for scale inhibitor A Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4001A shall calculate the total flow for scale inhibitor B Gjøa. Reset of 42FQI4001A shall be manually done by the operator (42HIS3002).

42FQI4001B shall calculate the total flow for scale inhibitor B Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4002A/4003A/4004A shall calculate the total flow for scale inhibitor C Gjøa. Reset of 42FQI4002A/4003A/4004A shall be manually done by the operator (42HIS3003/3004/3005).

42FQI4002B/4003B/4004B shall calculate the total flow for scale inhibitor C Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4005A shall calculate the total flow for scale inhibitor A Vega. Reset of 42FQI4005A shall be manually done by the operator (42HIS3006).

42FQI4005B shall calculate the total flow for scale inhibitor A Vega the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.2Control of Scale Inhibitor from Gjøa to Nova

Refer to SCD: C097-RWP-J-XL-4230-01 and C097-AKG-J-XL-4203-01

Scale inhibitor (upstream 2nd stage separator, utilizing existing storage tank 42TB003 and injection pumps 42PD003A/B inside Gjøa chemical injection package for continuous injection of scale inhibitor is implemented for Nova wells.

42FICV0025 and 42FICV0026 are a self-regulating type of control valves with integrated controllers and transmitters (Skoflo) installed in the injection line to control the flow rate and ensure correct dosing rate to Nova production flowlines A and B respectively.

42FICV0027 is a self-regulating type of control valve with integrated controller and transmitter (Skoflo) installed in the injection line to control the flow rate and ensure correct dosing rate to Gjøa oil header.

The setpoints of the flowrate to each flow control valve will be set manually by operator, either from HMI in control room (42HIT0025/42HIT0026/42HIT0027) or from keypad in local cabinet 42JX001. When the sum of the setpoints is higher than 0.1 l/h a tabulated function (30% - 95%) will determine the setpoints toward the controllers 42FIC0028A and 42FIC0028B (the operator will select which pump to be used setting the respective controller to AUTO). The output of the controllers will be 95% if the setpoint is higher than 0.1 l/h. The pressure in the system is set by 42PCV1013 (manual). The SkoFlo valves will receive their setpoints when the pressure transmitter 42PIT4100.BXH is active. Autonomous flow measurement and constant setpoint regulation will be automatically enable in the SkoFlo valves.

When the sum of setpoints from the SkoFlo valves return to 0 l/h, the selected pump will return to 0% and setis set to standby mode. The SkoFlo features will be shut-off automatically

42FQI0025 calculates the total flow for scale inhibitor injected to Nova flowline A during last 24 hours. This value is automatically reset at 00:00 every day.

42FQI0026 calculates the total flow for scale inhibitor injected to Nova flowline B during last 24 hours. This value is automatically reset at 00:00 every day.

42FQI0027 calculates the total flow for scale inhibitor injected Gjøa Oil flowline during last 24 hours. This value is automatically reset at 00:00 every day.

6.2.2.3 Control of Scale Inhibitor B Vega

Refer to SCD: C097-AKG-J-XL-4205-01.

The pumps 42PD059A/B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pump 42PD059A is driven by the electrical motor 42PD059A-M01.

The pump 42PD059B is driven by the electrical motor 42PD059B-M01.

Circulation pump 42PA059 is driven by electrical motor 42PA059-M01. The operator initiates the start sequence (42HIS3031) for 42PA059. The circulation pump shall then start and stop automatically. The operator shall set the time between start and stop of circulation. Refer to chapter 6.2.5.

42FQI4006A shall calculate the total flow in this system. Reset of 42FQI4006A shall be manually done by the operator (42HIS3007).

42FQI4006B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.4 Control of Scale Inhibitor A/B Gjøa

Refer to SCD: C097-AKG-J-XL-4201-01 and C097-AKG-J-XL-4202-01.

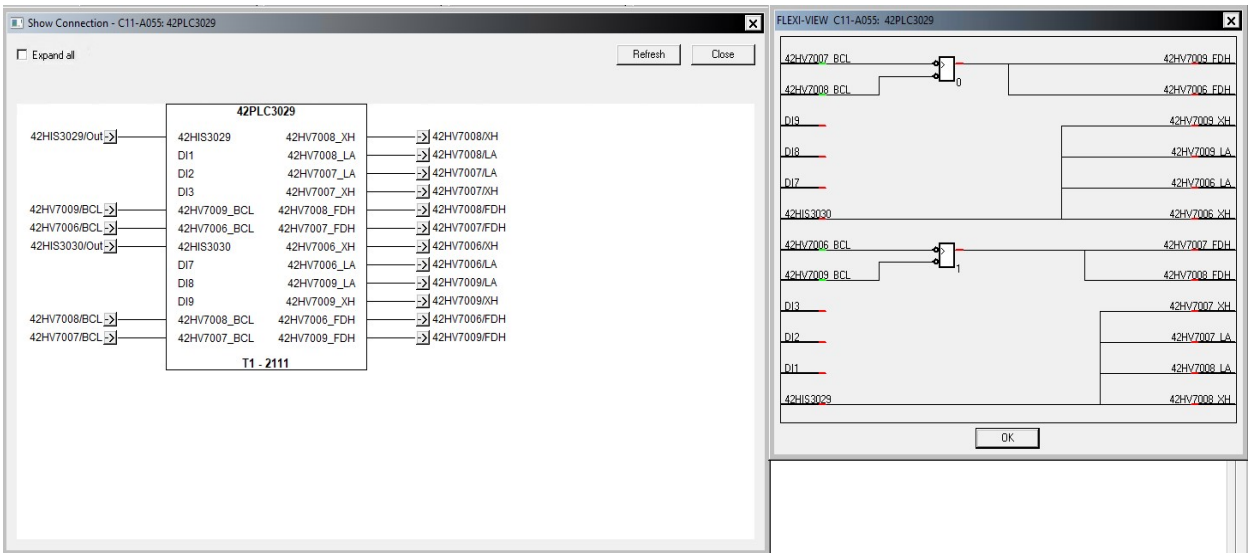
For the filling and cleaning of scale inhibitor 'B' will require software interlocks to be provided for several new isolation valves on the extended scale inhibitor 'A' pump circulation loop to prevent mixing of scale inhibitor 'A' and 'B'. The loop will consist of (4) isolates valves; Two in the suction 42HV7008, 42HV7009 and two in the discharge 42HV7006, 42HV7007. Filling operation shall be manually done by operator (42HIS3029 and 42HIS3030).

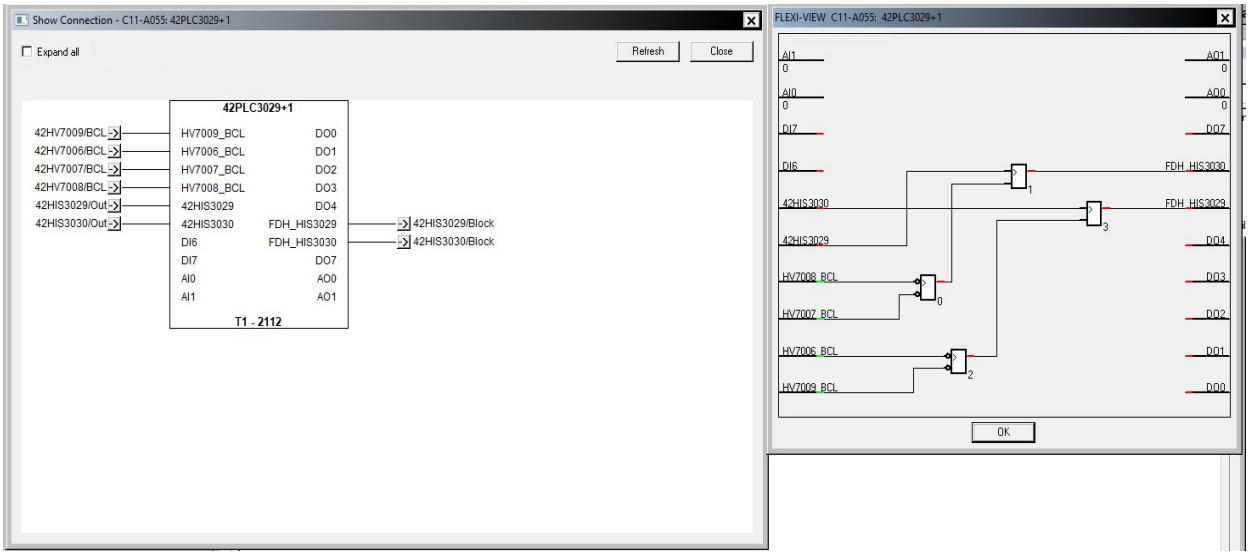
Filling operation as described below:

Valve	Action Scale Inhibitor "A"	Action Scale Inhibitor "B"
42HV7006	Closed	Open
42HV7007	Open	Closed
42HV7008	Open	Closed
42HV7009	Closed	Open

In addition to the above, an interlock for valves 42HV7006/7/8/9 implemented when the valves are operated manually. The flexi logic checks the below conditions of the valves for the manual operation:

- When either 42HV7006 or 42HV7009 is not confirmed closed, the valves 42HV7007 & 42HV7008 shall be prevented to be opened.
- When either 42HV7007 or 42HV7008 is not confirmed closed, the valves 42HV7006 & 42HV7009 shall be prevented to be opened.





6.2.2.5 Control of Wax Inhibitor Gjøa

Refer to SCD: C097-AKG-J-XL-4206-01.

The pumps 42PD005A/B and 42PD018A/B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PD005A/018A is driven by the same electrical motor 42PD005A-M01.

The pumps 42PD005B/018B is driven by the same electrical motor 42PD005B-M01.

42FQI4007A/4008A shall calculate the total flow in this system. Reset of 42FQI4008A shall be manually done by the operator (42HIS3008/3009).

42FQI4007B/4008B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.6 Control of Wax Inhibitor Vega

Refer to SCD: C097-AKG-J-XL-4207-01.

The pumps 42PD055A/B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PD055A is driven by the electrical motor 42PD055A-M01.

The pumps 42PD055B is driven by the electrical motor 42PD055B-M01.

Circulation pump 42PA055 is driven by electrical motor 42PA055-M01. The operator initiates the start sequence (42HIS3035) for 42PA055. The circulation pump shall then start and stop automatically. The operator shall set the time between start and stop of circulation. Refer to chapter 6.2.5.

42FQI4009A shall calculate the total flow in this system. Reset of 42FQI4009A shall be manually done by the operator (42HIS3010).

42FQI4009B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.7 Control of Wax Inhibitor Duva

Refer to SCD: C097-RWP-J-XL-4224-01.

The injection pumps 42PD701A/B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The circulation pump 42PA701 is 1x100% pump.

The pumps 42PD701A/B is driven by individual electrical motors 42PD701A/B-M01.

The pump 42PA701 is driven by the electrical motor 42PD701-M01. The operator initiates the start sequence (42HIS3060) for 42PA701. The recirculation pump shall then start and stop automatically within interval time. The operator shall set the time between start and stop of circulation. The time interval will be set when chemical selection is done.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC7025A shall control the injection rate when pump 42PD701A is in operation and 42FIC7025B shall control injection rate for the pump 42PD701B.

Both flow controllers read the flow from the same flow transmitter 42FIT7025 installed on common discharge line of the pumps and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY7025A/ 42ZY7025B shall be shut down.

42FQI7025A/B shall calculate the total flow in this system. Reset of 42FQI7025A shall be manually done by the operator (42HIS7025).

42FQI7025A/B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

Pressure transmitter 42PT7018/42PT7019 installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have remote indicator to give warning alarm High to the operator.

On-off control of the heater 42FE701 is controlled from 42TIC7032. The heater will be turned on when the temperature of the fluid in the storage tank is 19°C and turned off when the temperature of the fluid is 21°C in the storage tank.

The values from 42TT7032 and 42TST7015 will be compared continuously and the operator will get an alarm for high & low and when the difference between values are above 7°C (42TDI7032).

6.2.2.8 Control of Demulsifier Gjøa & Vega

Refer to SCDs: C097-AKG-J-XL-4208-01/4209-01.

The pumps 42PD006A/009A/020A/053A/060A and 42PD006B/009B/020B/053B/060B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PA006A/009A/020A/053A/060A is driven by the same electrical motor 42PA006A-M01.

The pumps 42PA006B/009B/020B/053B/060B is driven by the same electrical motor 42PA006B-M01.

42FQI4010A/4011A/4012A shall calculate the total flow for demulsifier Gjøa. Reset of 42FQI4010A/4011A/4012A shall be manually done by the operator (42HIS3011/3012/3013).

42FQI4010B/4011B/4012B shall calculate the total flow for demulsifier Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4013A/4014A shall calculate the total flow for demulsifier Vega. Reset of 42FQI4013A/4014A shall be manually done by the operator (42HIS3014/3015).

42FQI4013B/4014B shall calculate the total flow for demulsifier Vega the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.9 Control of Antifoam Gjøa

Refer to SCD: C097-AKG-J-XL-4210-01.

The pumps 42PD004A/021A/022A and 42PD004B/021B/022B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PA004A/021A/022A is driven by the same electrical motor 42PA004A -M01.

The pumps 42PA004B/021B/022B is driven by the same electrical motor 42PA004B-M01.

42FQI4015A/4016A/4017A shall calculate the total flow for antifoam Gjøa. Reset of 42FQI4015A/4016A/4017A shall be manually done by the operator (42HIS3016/3017/3018).

42FQI4015B/4016B/4017B shall calculate the total flow for antifoam Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.10 Control of Flocculant Gjøa

Refer to SCD: C097-AKG-J-XL-4211-01.

The pumps 42PD007A/023A/024A and 42PD007B/023B/024B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PA007A/023A/024A is driven by the same electrical motor 42PA007A-M01.

The pumps 42PA007B/023B/024B is driven by the same electrical motor 42PA007B-M01.

42FQI4018A/4019A/4020A shall calculate the total flow for flocculant Gjøa. Reset of 42FQI4018A/4019A/4020A shall be manually done by the operator (42HIS3019/3020/3021).

42FQI4018B/4019B/4020B shall calculate the total flow for flocculant Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.11 Control of Oxygen Scavenger & Biocide

Refer to SCDs: C097-AKG-J-XL-4212-01/4213-01.

The pumps 42PD008A/014A and 42PD008B/014B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PD008A/014A is driven by the same electrical motor 42PA008A-M01.

The pumps 42PD008B/014B is driven by the same electrical motor 42PA008B-M01.

42FQI4021A shall calculate the total flow for oxygen scavenger Gjøa. Reset of 42FQI4021A shall be manually done by the operator (42HIS3022).

42FQI4021B shall calculate the total flow for oxygen scavenger Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4022A shall calculate the total flow for biocide Gjøa. Reset of 42FQI4022A shall be manually done by the operator (42HIS3023).

42FQI4022B shall calculate the total flow for biocide Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.12 Control of Corrosion Inhibitor Gjøa/Vega & pH Inhibitor Vega

Refer to SCDs: C097-AKG-J-XL-4214-01/4215-01/4216-01.

The pumps 42PD015A/052A/054A and 42PD015B/052B/054B is 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PD015A/052A/054A is driven by the same electrical motor 42PA015A-M01.

The pumps 42PD015B/052B/054B is driven by the same electrical motor 42PA015B-M01.

42FQI4023A shall calculate the total flow for corrosion inhibitor Gjøa. Reset of 42FQI4023A shall be manually done by the operator (42HIS3024).

42FQI4023B shall calculate the total flow for corrosion inhibitor Gjøa the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4024A shall calculate the total flow for corrosion inhibitor Vega. Reset of 42FQI4024A shall be manually done by the operator (42HIS3025).

42FQI4024B shall calculate the total flow for corrosion inhibitor Vega the last 24 hours. This flow is automatically reset everyday at 12.00am.

42FQI4025A shall calculate the total flow for pH stabiliser Vega. Reset of 42FQI4025A shall be manually done by the operator (42HIS3026).

42FQI4025B shall calculate the total flow for pH stabiliser Vega the last 24 hours. This flow is automatically reset everyday at 12.00am.

6.2.2.13 Control of Scale Inhibitor Nova

Refer to SCD: C097-RWP-J-XL-4219-01.

The pumps 42PD027A/B are 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pump 42PD027A is driven by the electrical motor 42PD027A-M01.

The pump 42PD027B is driven by the electrical motor 42PD027B-M01.

Recirculation pump 42PA002 is driven by electrical motor 42PA002-M01. The operator initiates the start sequence (42HIS3050) for 42PA002. The recirculation pump shall then start and stop automatically within time interval. The operator shall set the time between start and stop of circulation. The time interval will be set when chemical selection is done.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC0047A shall control the injection rate when pump 42PD027A is in operation and 42FIC0047B shall control injection rate for the pump 42PD027B.

Both flow controllers read the flow from the same flow transmitter 42FT0047 installed on common discharge line of the pumps and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY0047A / 42ZY0047B shall be shut down.

On-off control of the heater 42FE004 is controlled from 42TIC1009. The heater will be turned on when the temperature of the fluid in the storage tank is 19°C and turned off when the temperature of the fluid is 22°C in the storage tank. There is also a local high-high temperature switch TSHH included in the control circuit which has set point at 90°C, when TSHH is activated the heater is tripped via MCC.

Heater 42FE004 is also tripped by SAS upon Low-Low level (42LT0037) in Nova Scale Inhibitor tank 42TB027.

Pressure transmitter 42PT0038/42PT0040 installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have local and remote indicator to give warning alarm High to the operator.

42FQI0047A shall calculate the total flow in this system. Reset of 42FQI0047A shall be manually done by the operator (42HIS0047).

42FQI0047B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

6.2.2.14 Control of Asphaltene/Wax Inhibitor Nova

Refer to SCD: C097-RWP-J-XL-4220-01.

The pumps 42PD028A/B are 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pump 42PD028A is driven by the electrical motor 42PD028A-M01.

The pump 42PD028B is driven by the electrical motor 42PD028B-M01.

Recirculation pump 42PA003 is driven by electrical motor 42PA003-M01. The operator initiates the start sequence (42HIS3055) for 42PA003. The recirculation pump shall then start and stop automatically within interval time. The operator shall set the time between start and stop of circulation. The time interval will be set when chemical selection is done.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC0066A shall control the injection rate when pump 42PD028A is in operation and 42FIC0066B shall control injection rate for the pump 42PD028B.

Both flow controllers read the flow from the same flow transmitter 42FT0066 installed on common discharge line of the pumps and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY0066A/ 42ZY0066B shall be shut down.

On-off control of the heater 42FE002 is controlled from 42TIC1010. The heater will be turned on when the temperature of the fluid in the storage tank is 19°C and turned off when the temperature of the fluid is 22°C in the storage tank. There is also a local high-high temperature switch TSHH included in the control circuit which has set point at 90°C, when TSHH is activated, the heater is tripped via MCC.

Heater 42FE002 is also tripped by SAS upon Low-Low level (42LT0058) in Nova Asphaltene/Wax Dispersant tank 42TB028.

Pressure transmitter 42PT0060/42PT0062 installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have local and remote indicator to give warning alarm High to the operator.

42FQI0066A shall calculate the total flow in this system. Reset of 42FQI0066A shall be manually done by the operator (42HIS0066).

42FQI0066B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

6.2.2.15 Control of Corrosion Inhibitor Nova

Refer to SCD: C097-RWP-J-XL-4221-01.

The pumps 42PD010A/B are 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pumps 42PD010A is driven by the electrical motor 42PD010A-M01.

The pumps 42PD010B is driven by the electrical motor 42PD010B-M01.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC0053A shall control the injection rate when pump 42PD010A is in operation and 42FIC0053B shall control injection rate for the pump 42PD010B.

Both flow controllers read the flow from the same flow transmitter 42FT0053 installed on common discharge line of the pumps and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY0053A/ 42ZY0053B shall be shut down.

Pressure transmitter 42PT0048/42PT0050 are installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have local and remote indicator to give warning alarm High to the operator.

42FQI0053A shall calculate the total flow in this system. Reset of 42FQI0053A shall be manually done by the operator (42HIS0053).

42FQI0053B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

42FICV0078/42FICV0079 is a self-regulating type of control valve with integrated controller and transmitter (Skoflo) which installed in the injection line to control the flow rate and ensure correct dosing rate to Nova flowline A/B.

The set points of the flowrate to each flow control valve should be set manually by operator, either from HMI in control room or from keypad in local cabinet 42JX002.

6.2.2.16 Control of Biocide Nova

Refer to SCD: C097-RWP-J-XL-4222-01.

The pumps 42PD013A/B are 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pump 42PD013A is driven by the electrical motor 42PD013A-M01.

The pump 42PD013B is driven by the electrical motor 42PD013B-M01.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC0007A shall control the injection rate when pump 42PD013A is in operation and 42FIC0007B shall control injection rate for the pump 42PD013B.

Both flow controller read the flow from the same flow transmitter 42FT0007 installed on common discharge line of the pumps and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY0007A/ 42ZY0007B shall be shut down.

On-off control of the heater 42FE003 is controlled from 42TIC1011. The heater will be turned on when the temperature of the fluid in the storage tank is 19°C and turned off when the temperature of the fluid is 22°C in the storage tank. There is also a local High-High temperature switch TSHH included in the control circuit which has set point at 90°C, when TSHH is activated, the heater is tripped via MCC.

Heater 42FE003 is also tripped by SAS upon Low-Low level (42LT0001) in Nova Biocide storage tank 42TB013.

Pressure transmitter 42PT0002/42PT0004 are installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have local and remote indicator to give warning alarm High to the operator.

42FQI0007A shall calculate the total flow in this system. Reset of 42FQI0007A shall be manually done by the operator (42HIS0007).

42FQI0007B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

6.2.2.17 Control of H2S Scavenger Nova

Refer to SCD: C097-RWP-J-XL-4223-01.

The pumps 42PD029A/B are 2x100% pumps (duty/standby). Duty/standby selection is done by manual operation.

The pump 42PD029A is driven by the electrical motor 42PD029A-M01.

The pump 42PD029B is driven by the electrical motor 42PD029B-M01.

There is one dedicated flow controller for each pump to control the injection flow rate. 42FIC0015A shall control the injection rate when pump 42PD029A is in operation and 42FIC0015B shall control injection rate for the pump 42PD029B.

Both flow controllers read the flow from the same flow transmitter 42FT0015 installed on common discharge line and control the stroke length for the corresponding pump. When the pump is not in operation the corresponding FIC shall be interlocked and output shall be set to Zero and the stroke actuator 42ZY0015A/ 42ZY0015B shall be shut down.

On-off control of the heater 42FE001 is controlled from 42TIC1012. The heater will be turned on when the temperature of the fluid in the storage tank is 19°C and turned off when the temperature of the fluid is 22°C in the storage tank. There is also a local High-High temperature switch TSHH included in the control circuit which has set point at 90°C, when TSHH is activated, the heater is tripped via MCC.

Heater 42FE001 is also tripped by SAS upon Low-Low level (42LT0009) in H2S Scavenger storage tank 42TB029.

Pressure transmitter 42PT0010/42PT0012 are installed to detect breaks (rupture) of corresponding pump diaphragm. The PT's will have local and remote indicator to give warning alarm High to the operator.

42FQI0015A shall calculate the total flow in this system. Reset of 42FQI0015A shall be manually done by the operator (42HIS0015).

42FQI0015B shall calculate the total flow in this system the last 24 hours. This flow is automatically reset every day at 12.00am.

6.2.2.18 Chemical injection – level measurements

Ref. to SCDs:

C097AKG-J-XL-4201-01/4202-01/4203-01/4204-01/4205-01/4206-01/4207-01/4208-01/4209-01/4210-01/4211-01/4212-01/4213-01/4214-01/4215-01/4216-01/4217-01/4218-01/4224-01

C097-RWP-J-XL-4219-01/4220-01/4221-01/4222-01/4223-01

Chemical injection tanks 42TB001, 42TB002, 42TB003, 42TB051, 42TB059, 42TB005, 42TB055, 42TB006, 42TB053, 42TB004, 42TB007, 42TB008, 42TB013, 42TB014, 42TB015, 42TB052, 42TB054, 42TB009, 42TB010, 42TB011, 42TB056, 42TB012, 42TB025, 42TB026, 42TB058, 42TB701, 42TB702, 42TB027, 42TB028, 42TB029 shall have level measurement unit in volume [Litres] and % on the VDU.

The following tables need to be implemented for the respective tanks.

Scale inhibitor A Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB001	0	0
	3	7000

Scale inhibitor B Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB002	0	0
	3	2900

Scale inhibitor C Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB003	0	0
	3	7000

Scale inhibitor A Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB051	0	0
	3	1800

Scale inhibitor B Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB059	0	0
	3	500

Wax inhibitor Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB005	0	0
	3	10000

Wax inhibitor Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB055	0	0
	3	28000

Wax inhibitor Duva

Tag number	Ref. height [m]	Volume [Litres]
42TB701	4,0	39000

LDHI Duva

Tag number	Ref. height [m]	Volume [Litres]
42TB703	3,5	3000

Demulsifier Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB006	0	0
	3	4100

Demulsifier Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB053	0	0
	3	600

Antifoam Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB004	0	0
	3	5200

Flocculant Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB007	0	0
	3	2200

Oxygen scavenger Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB008	0	0
	3	1000

Biocide Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB014	0	0
	3	1000

Corrosion inhibitor Gjøa

Tag number	Ref. height[m]	Volume [Litres]
42TB015	0	0
	3	2000

Corrosion inhibitor Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB052	0	0
	3	1000

Scale inhibitor Nova

Tag number	Ref. height[m]	Volume [Litres]
42TB027	0	0
	2.45	6730

Asphaltene/wax inhibitor Nova

Tag number	Ref. height[m]	Volume [Litres]
42TB028	0	0
	2.45	3610

Corrosion inhibitor Nova

Tag number	Ref. height[m]	Volume [Litres]
42TB010	0	0
	1.418	3000

Biocide Nova

Tag number	Ref. height[m]	Volume [Litres]
42TB013	0	0
	2.45	6010

H2S Scavenger Nova

Tag number	Ref. height[m]	Volume [Litres]
42TB029	0	0
	2.45	3610

pH stabiliser Vega

Tag number	Ref. height[m]	Volume [Litres]
42TB054	0	0
	3	15000

Spare and test tanks Gjøa/ Vega/ Nova

Tag number	Ref. height [m]	Volume [Litres]
42TB009	0	0
42TB009	3	3000
42TB011	0	0
42TB011	3	30000
42TB056	0	0
42TB056	3	3000
42TB030	2.45	4870

Chemical spill tanks Gjøa/ Vega/Duva/ Nova

Tag number	Ref. height[m]	Volume [Litres]

Tag number	Ref. height[m]	Volume [Litres]
42TB012		
42TB012		
42TB025		
42TB025		
42TB026		
42TB026		
42TB058		
42TB058		
42TB702	0,46	3150
42TB704	0,46	850

6.2.2.19 Chemical injection – flow measurements

Refer to SCDs: C097-AKG-J-XL-4201-01 to 4216-01, C097-RWP-J-XL-4219-01 to 4224-01

The flow measurements shall be displayed in m3/h only on the VDU. The density for each chemical used is hard coded in a PLC module.

6.2.2.20 Low pass filter flow transmitter

Refer to SCDs: C097-AKG-J-XL-4201-01 to 4216-01, C097-RWP-J-XL-4219-01 to 4223-01

The flow signal for 42FIT4000 to 4025 and 42FT0047/0066/0053/0007/0015 shall be low pass filtered such that large changes in measured flow for a short period is not indicated. The time constant for the low pass filter shall be approximately 15 seconds (tuned during commissioning).

6.2.2.21 Low pass filter level transmitter

Refer to SCDs: C097-AKG-J-XL-4201-01 to 4216-01, C097-RWP-J-XL-4219-01 to 4223-01

The level signal for 42LT4060 to 4085 and 42LT0037/0058/0001/0009/4079 shall be low pass filtered such that large changes in measured level for a short period is not indicated. The time constant for the low pass filter shall be approximately 10 seconds (tuned during commissioning).

And additional low pass filtering is added on additional modules to be used for daily consumption based on level measurement every midnight. This low pass filter is set to 10 minutes.

6.2.3 Specific control structures for startup

NA

6.2.4 Specific control structures for planned shutdown

NA

6.2.5 Special solutions

6.2.5.1 Control of chemical injections valves

Refer to SCDs: C097-AKG-J-XL-4201-01 to 4216-01.

Control of the chemical injection valves shall be done by control of an actuator per pump. Signal interface is via modbus serial lines. The KM module valvec (#AV) regulates the pump volume. To command the valves use the Preset Single register. Status from the valves comes from reading the read only register. The valves can be commanded to a pre-defined position, step up/down, run to 0% and stop. Stop halts the current command issued to the valve.

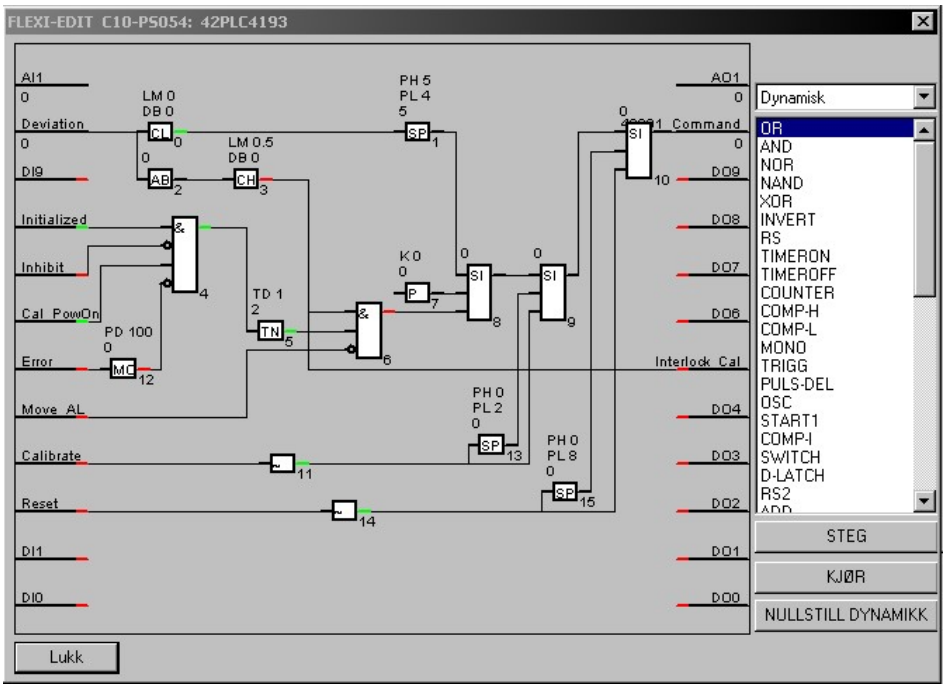
The actuator may not be able to move (Pump override actuator bit 2 "Can not move" in status register 30001). The reasons may be:

- The screw that shall lock the actuator in 0-position is active
- Another physical obstacle prevents the actuator to rotate, for example that the pumps calibration screw provisionally needs a moment beyond what the actuator is able to give.

If bit 2 "Can not move" is set, the logic prevents commands to the actuator. This is done by sending “4” or “5” to modbus register 40001.

An own alarm is displayed beside each pump symbol.

An own reset push button in each VDU is implemented to reset faults. This is done by “reset faults” to register 40001.



6.2.5.2 42PLC3030/42PLC3034/42PLC3038/42PLC3053/42PLC3058/42PLC3059

Refer to SCDs: C097-AKG-J-XL-4201-01/4205-01/4207-01/4219-01/4224-01.

The 42PLC3030/3034/3038/3053/3058/3059 flexi modules shall automatically start and stop the corresponding circulation pump based on time input from the operator. If start sequence push button is pushed by the operator, the pump shall run/be stopped based on the timer out signals from outside (see table below) the flexi

module. The flexi modules shall set a pulse to the LA terminal every time it changes value (0 -> 1) on the start or stop output terminals to the pump. The start sequence push button shall be on when activated (no pulse). To stop the sequence, the operator must deactivate 42HIS3027/3031/3035/3050/3055/3060.

The operator set on and off time of the circulation pump by changing the time parameter in the following function blocks:

Circulation pump	On time	Off time
42PA001	42KY3028	42KY3029
42PA059	42KY3032	42KY3033
42PA055	42KY3036	42KY3037
42PA701	42KY3061	42KY3062
42PA002	42KY3051	42KY3052
42PA003	42KY3056	42KY3057

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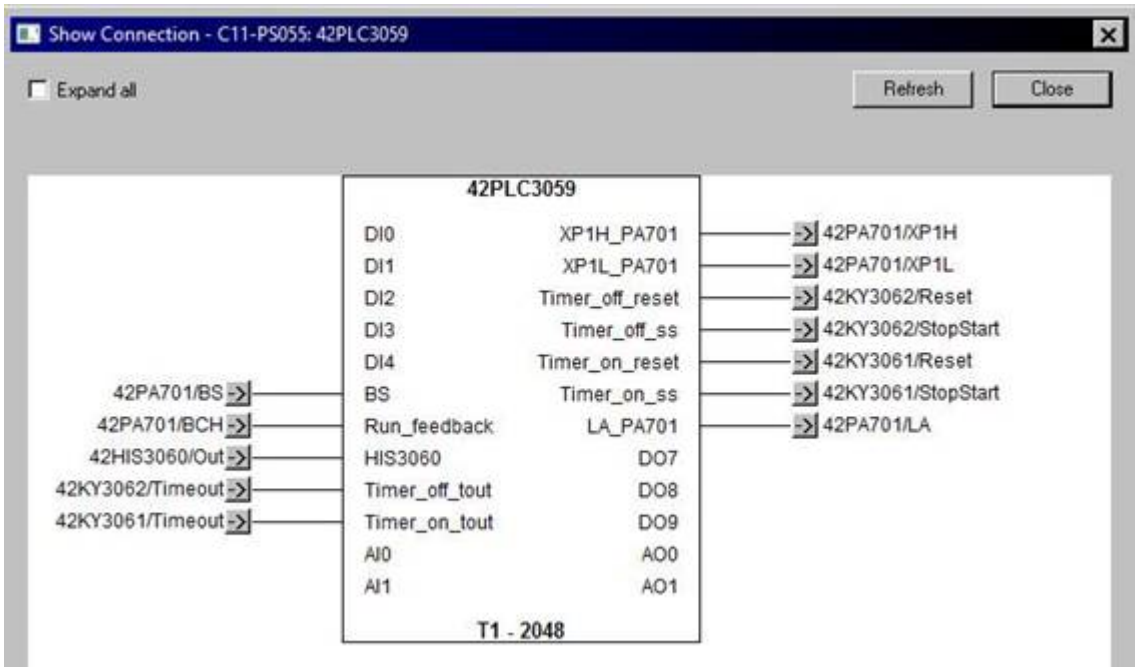

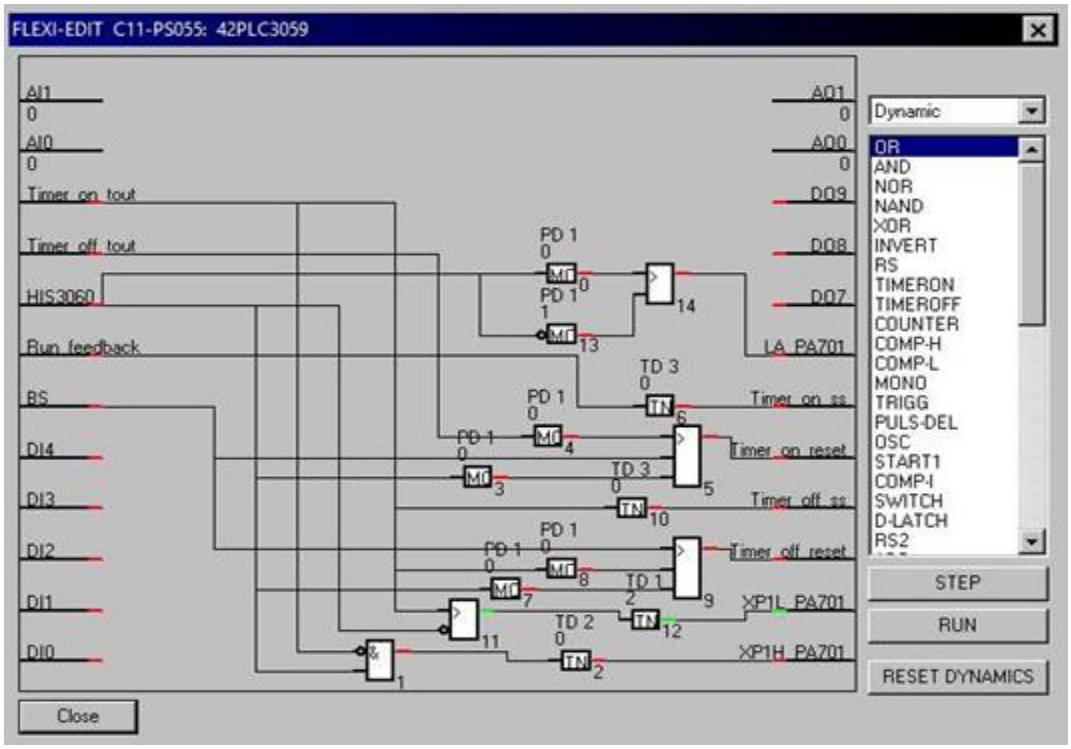

6.2.6 High-level functions

The SAS system shall communicate with Mongstad oil export, ref C097-AKG-J-SA-8706.

6.2.7 Potential problem areas

NA

6.3 Sequences

NA

6.3.1 Sub sequence

NA

6.4 Interfaces

6.4.1 Interfaces with other parts of SAS

Interface between C10, L04 and L06

Refer SCDs C097-AKG-J-XL-4201-01 to 4204-01.

The pressure transmitter 42PT4091 is connected to node C10, which has interface with the circulation pump 42PA001 that is connected with node L04.

The 42PLC3030 42 3030 is connected to node C10 which has interface with the circulation pump 42PA001 that is connected with node L04.

The USD level 6001 is connected to node C10, which has interface with the injection pump motor 42PD001A-M01 that is connected with node L04.

The USD level 6002 is connected to node C10, which has interface with the injection pump motor 42PD001B-M01 that is connected with node L06.

Refer SCD: C097-AKG-J-XL-4205-01

The flow transmitter 42FIT4006 is connected to node C11, which has interface to volume calculations in C10.

The pressure transmitter 42PT4111 is connected to node C10, which has interface with the circulation pump 42PD059 that is connected with node L04.

The 42PLC3034 is connected to node C10 which has interface with the circulation pump 42PA059 that is connected with node L04.

The USD level 6003 is connected to node C10, which has interface with the injection pump 42PD059A that is connected with node L04.

The USD level 6004 is connected to node C10, which has interface with the injection pump 42PD059B that is connected with node L06.

Refer SCD: C097-AKG-J-XL-4206-01

The USD level 6005is connected to node C10, which has interface with the injection pump motor 42PD005A-M01 that is connected with node L04.

The USD level 6006 is connected to node C10, which has interface with the injection pump motor 42PD005B-M01 that is connected with node L06.

Refer SCD C097-AKG-J-XL-4207-01

The pressure transmitter 42PT4122 is connected to node C10, which has interface with the circulation pump 42PA055 that is connected with node L04.

The 42PLC3038 is connected to node C10 which has interface with the circulation pump 42PA055 that is connected with node L04.

The USD level 6007 is connected to node C10, which has interface with the injection pump 42PD055A that is connected with node L04.

The USD level 6008 is connected to node C10, which has interface with the injection pump 42PD055B that is connected with node L06.

Refer SCDs C097-AKG-J-XL-4208-01 to 4209-01.

The USD level 6009 is connected to node C10, which has interface with the injection pump motor 42PD006A-M01 that is connected with node L04.

The USD level 6010 is connected to node C10, which has interface with the injection pump motor 42PD006B-M01 that is connected with node L06.

Refer SCD C097-AKG-J-XL-4210-01

The USD level 6011 is connected to node C10, which has interface with the injection pump motor 42PD004A-M01 that is connected with node L04.

The USD level 6012 is connected to node C10, which has interface with the injection pump motor 42PD004B-M01 that is connected with node L06.

Refer SCD C097-AKG-J-XL-4211-01

The flow transmitter 42FIT4019 is connected to node C11, which has interface to volume calculations in C10.

The USD level 6013 is connected to node C10, which has interface with the injection pump motor 42PD007A-M01 that is connected with node L04.

The USD level 6014 is connected to node C10, which has interface with the injection pump motor 42PD007B-M01 that is connected with node L06.

Refer SCD: C097-AKG-J-XL-4212-01 to 4213-01

The USD level 6015 is connected to node C10, which has interface with the injection pump motor 42PD008A-M01 that is connected with node L04.

The USD level 6016 is connected to node C10, which has interface with the injection pump motor 42PD008B-M01 that is connected with node L06.

Refer SCDs C097-AKG-J-XL-4214-01 to 4216-01.

The USD level 6017 is connected to node C10, which has interface with the injection pump motor 42PD015A-M01 that is connected with node L04.

The USD level 6018 is connected to node C10, which has interface with the injection pump motor 42PD015B-M01 that is connected with node L06.

Interface between C16, L20 and L21

Refer SCD: C097-RWP-J-XL-4219-01

The USD level 6029 is connected to node C16, which has interface with the injection pump motor 42PD027A-M01 that is connected to node L20.

The USD level 6030 is connected to node C16, which has interface with the injection pump motor 42PD027B-M01 that is connected to node L21.

The USD level 6031 is connected to node C16, which has interface with the injection pump motor 42PA002-M01 that is connected to node L20.

The 42TT1009 and 42LT0037 is connected to node C16, which has interface with the scale inhibitor heater 42FE004 that is connected to node L21.

Refer SCD: C097-RWP-J-XL-4220-01

The USD level 6021 is connected to node C16, which has interface with the injection pump motor 42PD028A-M01 that is connected to node L20.

The USD level 6022 is connected to node C16, which has interface with the injection pump motor 42PD028B-M01 that is connected to node L21.

The USD level 6032 is connected to node C16, which has interface with the injection pump motor 42PA003-M01 that is connected to node L21.

The 42TT1010 and 42LT0058 is connected to node C16, which has interface with the Asphaltene/ wax dispersant heater 42FE002 that is connected to node L21.

Refer SCD: C097-RWP-J-XL-4221-01

The USD level 6023 is connected to node C16, which has interface with the injection pump motor 42PD010A-M01 that is connected to node L04.

The USD level 6024 is connected to node C16, which has interface with the injection pump motor 42PD010B-M01 that is connected to node L06.

The 42LT4079 is connected to node C10, which has interface to USD level 6023 and 6024 that are connected to node C16.

Refer SCD: C097-RWP-J-XL-4222-01

The USD level 6025 is connected to node C16, which has interface with the injection pump motor 42PD013A-M01 that is connected to node L20.

The USD level 6026 is connected to node C16, which has interface with the injection pump motor 42PD013B-M01 that is connected to node L21.

The 42TT1011 and 42LT0001 is connected to node C16, which has interface with the biocide heater 42FE003 that is connected to node L21.

Refer SCD: C097-RWP-J-XL-4223-01

The USD level 6027 is connected to node C16, which has interface with the injection pump motor 42PD029A-M01 that is connected to node L20.

The USD level 6028 is connected to node C16, which has interface with the injection pump motor 42PD029B-M01 that is connected to node L21.

The 42TT1012 and 42LT0009 is connected to node C16, which has interface with the H2S Scavenger heater 42FE001 that is connected to node L21.

Refer SCD C097-RWP-J-XL-4224-01.

The USD level 6034 is connected to node C11, which has interface with the injection pump motor 42PA701-M01 that is connected with node L04.

The USD level 6035 is connected to node C11, which has interface with the injection pump motor 42PD701A-M01 that is connected with node L04.

The USD level 6036 is connected to node C11, which has interface with the injection pump motor 42PD701B-M01 that is connected with node L06.

6.4.2 Interfaces with external (non-SAS) control systems

Dynamic information of measurements for mooring, vessel draft, and levels for all compartments in hull and topside modelled in the stability model by the Marine discipline are transferred to the load calculator through the OPC servers. Most of the measure signals are converted in a PLC to accommodate the load calculators required input unit, see document C097-AKG-J-LA-8703, OPC LIST FOR LOAD CALCULATOR for details.

6.5 Alarms

The reader is referred to C097-AKG-J-KA-0001, Alarm system development procedure for documentation of the alarm evaluation process. Alarm texts and semantics are specified in C097-AKG-J-RA-0100, and alarm system

operation and maintenance are specified in C097-AKG-J-RA-0100. Alarm suppression which is local for this system is specified in section 6.5.3 below. Global alarm suppression (spanning two or more nodes) is specified in C097-AKG-J-RA-0100.

6.5.1 Single alarms

Refer to document C097-AKG-J-LA-4201, “Software kesys report system 42 Chemical Injection System”.

6.5.2 Alarm Context

Refer to document C097-AKG-J-XR-4201-01, Context and Hiding diagram

6.5.3 Local alarm suppression

The following alarm suppression mechanisms are defined within this system:

Scale Inhibitor A/B/C Gjøa

Low and Low-low pressure alarms 42PT4091 of circulation pump are suppressed initially during the pump starts running.

Low discharge flow alarms 42FIT4000 of scale inhibitor A are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4094 on the discharge line of scale inhibitor A are suppressed initially during the pump starts running.

Low discharge flow alarms 42FIT4001 of scale inhibitor B are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4097 on the discharge line of scale inhibitor B are suppressed initially during the pump starts running.

Low discharge flow alarms 42FIT4002 of scale inhibitor C are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4100 on the discharge line of scale inhibitor C are suppressed initially during the pump starts running.

Low discharge flow alarms 42FIT4003 of scale inhibitor C are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4103 on the discharge line of scale inhibitor C are suppressed initially during the pump starts running.

Low discharge flow alarms 42FIT4004 of scale inhibitor C are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4106 on the discharge line of scale inhibitor C are suppressed initially during the pump starts running.

Scale Inhibitor A/B Vega

Low discharge flow alarms 42FIT4005 of scale inhibitor A are suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4109 on the discharge line of scale inhibitor A are suppressed initially during the pump starts running.

Low and Low-low pressure alarms 42PT4111 on the discharge line of circulation pump scale inhibitor B are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4006 of scale inhibitor B is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4114 on the discharge line of scale inhibitor B are suppressed initially during the pump starts running.

Wax Inhibitor Gjøa

Low discharge flow alarm 42FIT4007 of wax inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4117 on the discharge line pressure of wax inhibitor are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4008 of wax inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4120 on the discharge line of wax inhibitor are suppressed initially during the pump starts running.

Wax Inhibitor Vega

Low and Low-low pressure alarms 42PT4122 on the discharge line of circulation pump wax inhibitor are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4009 of wax inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4125 on the discharge line of wax inhibitor are suppressed initially during the pump starts running.

Wax Inhibitor Duva

Low and Low-low pressure alarms 42PSIT7022/7023 on the discharge line of injection pumps wax inhibitor 42PD701A/B are suppressed initially during the pump starts running.

Low and Low-low pressure alarms 42PIT7012 on the discharge line of circulation pump wax inhibitor 42PA701 are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT7025 of wax inhibitor is suppressed initially during the pumps start running.

High level alarm 42LT7013 on the wax inhibitor storage tank 42TB701 is suppressed using 42HIS7013 during the 42PA701 pump starts running.

Demulsifier Gjøa

Low discharge flow alarm 42FIT4010 of demulsifier is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4128 on the discharge line of demulsifier are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4011 of demulsifier is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4131 on the discharge line of demulsifier are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4012 of demulsifier is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4134 on the discharge line of demulsifier are suppressed initially during the pump starts running.

Demulsifier Vega

Low discharge flow alarm 42FIT4013 of demulsifier is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4137 on the discharge line of demulsifier are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4014 of demulsifier is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4140 on the discharge line of demulsifier are suppressed initially during the pump starts running.

Antifoam Gjøa

Low discharge flow alarm 42FIT4015 of Antifoam is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4143 on the discharge line of Antifoam are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4016 of Antifoam is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4146 on the discharge line of Antifoam are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4017 of Antifoam is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4149 on the discharge line of Antifoam are suppressed initially during the pump starts running.

Flocculant Gjøa

Low discharge flow alarm 42FIT4018 of Flocculant is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4152 on the discharge line of Flocculant are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4019 of Flocculant is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4155 on the discharge line of Flocculant are suppressed initially during the pump starts running.

Low discharge flow alarm 42FIT4020 of Flocculant is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4158 on the discharge line of Flocculant are suppressed initially during the pump starts running.

Oxygen scavenger

Low discharge flow alarm 42FIT4021 of Oxygen scavenger is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4161 on the discharge line of Oxygen scavenger are suppressed initially during the pump starts running.

Biocide Gjøa

Low discharge flow alarm 42FIT4022 of Biocide is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4164 on the discharge line of Biocide are suppressed initially during the pump starts running.

Corrosion Inhibitor Gjøa

Low discharge flow alarm 42FIT4023 of Corrosion Inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4167 on the discharge line of Corrosion Inhibitor are suppressed initially during the pump starts running.

Corrosion Inhibitor Vega

Low discharge flow alarm 42FIT4024 of Corrosion Inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4170 on the discharge line of Corrosion Inhibitor are suppressed initially during the pump starts running.

pH Stabiliser Vega

Low discharge flow alarm 42FIT4025 of pH Stabiliser is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PIT4173 on the discharge line of pH Stabiliser are suppressed initially during the pump starts running.

Scale Inhibitor Nova

Low discharge flow alarm 42FT0047 of Nova scale inhibitor is suppressed initially during the pumps start running.

Low and Low-low pressure alarms from 42PST0045 of the discharge line of Nova scale inhibitor pumps are supressed initially during the pumps start running.

Low and Low-low pressure alarms 42PT0035 of the discharge line of Nova scale inhibitor circulation pump are supressed initially during the pump start running.

Asphaltene/Wax Inhibitor Nova

Low discharge flow alarm 42FT0066 of Nova Asphaltene/Wax dispersant is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PST0064 of the discharge line of Nova Asphaltene/Wax dispersant pumps are supressed initially during the pumps start running.

Low and Low-low pressure alarms 42PT0057 of the discharge line of Nova Asphaltene/Wax dispersant circulation pump are supressed initially during the pump start running.

Corrosion Inhibitor Nova

Low discharge flow alarm 42FT0053 of Nova Corrosion inhibitor is supressed initially during the pumps start running.

Low and Low-low pressure alarms 42PST0052 of the discharge line of Nova Corrosion Inhibitor pumps are supressed initially during the pump starts running.

Biocide Nova

Low discharge flow alarm 42FT0007 of Nova Biocide is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PT0006 of the discharge line of Nova Biocide pumps are supressed initially during the pumps start running.

H2S Scavenger Nova

Low discharge flow alarm 42FT0015 of Nova H2S Scavenger is suppressed initially during the pumps start running.

Low and Low-low pressure alarms 42PT0014 of the discharge line of Nova H2S Scavenger pumps are supressed initially during the pumps start running.

6.6 Trends and reports

The following trends and reports are defined for this system is:

Scale Inhibitor A/B/C Gjøa

42PT4091 – Discharge Pressure of Circulation pump of scale inhibitor A.

42LT4060 – Level of scale inhibitor A storage tank

42PT4092 – Pressure of injection pump of scale inhibitor A

42TT4180 – Temperature of injection pump of scale inhibitor A

42PT4093 – Pressure of injection pump of scale inhibitor A

42TT4181 – Temperature of injection pump of scale inhibitor A

42FIT4000 – Discharge flow of scale inhibitor A

42PIT4094 – Discharge pressure of scale inhibitor A

42LT4061 – Level of scale inhibitor B storage tank

42PT4095 – Pressure of injection pump of scale inhibitor B

42TT4182 – Temperature of injection pump of scale inhibitor B

42PT4096 – Pressure of injection pump of scale inhibitor B

42TT4183 – Temperature of injection pump of scale inhibitor B

42FIT4001 – Discharge flow of scale inhibitor B

42PIT4097 – Discharge pressure of scale inhibitor B

42LT4062 – Level of scale inhibitor C storage tank

42PT4098 – Pressure of injection pump of scale inhibitor C

42TT4184 – Temperature of injection pump of scale inhibitor C

42PT4099 – Pressure of injection pump of scale inhibitor C

42TT4185 – Temperature of injection pump of scale inhibitor C

42FIT4002 – Discharge flow of scale inhibitor C

42PIT4100 – Discharge pressure of scale inhibitor C

42PT4101 – Pressure of injection pump of scale inhibitor C

42TT4186 – Temperature of injection pump of scale inhibitor C

42PT4102 – Pressure of injection pump of scale inhibitor C

42TT4187 – Temperature of injection pump of scale inhibitor C

42FIT4003 – Discharge flow of scale inhibitor C

42PIT4103 – Discharge pressure of scale inhibitor C

42PT4104 – Pressure of injection pump of scale inhibitor C

42TT4188 – Temperature of injection pump of scale inhibitor C

42PT4105 – Pressure of injection pump of scale inhibitor C

42TT4189 – Temperature of injection pump of scale inhibitor C

42FIT4004 – Discharge flow of scale inhibitor C

42PIT4106 – Discharge pressure of scale inhibitor C

42PDIT0100 – Differential Pressure discharge line filters of scale inhibitor C

Scale Inhibitor A/B Vega

42LT4063 – Level of scale inhibitor A storage tank

42PT4107 – Pressure of injection pump of scale inhibitor A

42TT4190 – Temperature of injection pump of scale inhibitor A

42PT4108 – Pressure of injection pump of scale inhibitor A

42TT4191 – Temperature of injection pump of scale inhibitor A

42FIT4005 – Discharge flow of scale inhibitor A

42PIT4109 – Discharge pressure of scale inhibitor A

42PT4111 – Discharge Pressure of circulation pump of scale inhibitor B.

42LT4064 – Level of scale inhibitor B storage tank

42PT4112 – Pressure of injection pump of scale inhibitor B

42TT4192 – Temperature of injection pump of scale inhibitor B

42PT4113 – Pressure of injection pump of scale inhibitor B

42TT4193 – Temperature of injection pump of scale inhibitor B

42FIT4006 – Discharge flow of scale inhibitor B

42PIT4114 – Discharge pressure of scale inhibitor B

42PT1001 – Pressure on the distribution line

42FQI1002 – Flow totaliser on the distribution line

Wax Inhibitor Gjøa

42LT4065 – Level of wax inhibitor storage tank

42LT4066 – Level of wax inhibitor storage tank

42PT4115 – Pressure of injection pump of wax inhibitor

42PT4247 – Pressure of injection pump of wax inhibitor

42TT4194 – Temperature of injection pump of wax inhibitor

42TT4245 – Temperature of injection pump of wax inhibitor

42PT4116 – Pressure of injection pump of wax inhibitor

42PT4248 – Pressure of injection pump of wax inhibitor

42TT4195 – Temperature of injection pump of wax inhibitor

42TT4246 – Temperature of injection pump of wax inhibitor

42FIT4007 – Discharge flow of wax inhibitor

42PIT4117 – Discharge pressure of wax inhibitor

42PT4118 – Pressure of injection pump of wax inhibitor

42TT4196 – Temperature of injection pump of wax inhibitor

42PT4119 – Pressure of injection pump of wax inhibitor
42TT4197 – Temperature of injection pump of wax inhibitor
42FIT4008 – Discharge flow of wax inhibitor
42PIT4120 – Discharge pressure of wax inhibitor

Wax Inhibitor Vega

42PT4122 – Discharge Pressure of circulation pump of wax inhibitor
42LT4067 – Level of wax inhibitor storage tank
42LT4068 – Level of wax inhibitor storage tank
42PT4123 – Pressure of injection pump of wax inhibitor
42TT4198 – Temperature of injection pump of wax inhibitor
42PT4124 – Pressure of injection pump of wax inhibitor
42TT4199 – Temperature of injection pump of wax inhibitor
42FIT4009 – Discharge flow of wax inhibitor
42PIT4125 – Discharge pressure of wax inhibitor

Wax Inhibitor Duva

42PSIT7022 – Discharge Pressure of circulation pump 42PD701A of wax inhibitor
42PSIT7023 – Discharge Pressure of circulation pump 42PD701B of wax inhibitor
42LT7013 – Level of wax inhibitor storage tank 42TB701
42LIT7031 – Level of Duva Wax Inhibitor Spill Tanks
42PIT7012 – Pressure of circulation pump 42PA701 of wax inhibitor
42PT7018 – Inlet Pressure of injection pump 42PD701A of wax inhibitor
42PT7019 – Inlet Pressure of injection pump 42PD701B of wax inhibitor
42LST7014 – Duva wax inhibitor level switch
42TST7015 – Duva wax inhibitor tank safety temperature
42TT7032 – Duva wax inhibitor tank temperature
42PDT7001 – Pres. Diff. Trans. Wax Inhibitor (Station North)
42PDT7002 – Pres. Diff. Trans. Wax Inhibitor (Station South)

Demulsifier Gjøa

42LT4069 – Level of demulsifier storage tank
42PT4126 – Pressure of injection pump of demulsifier
42TT4200 – Temperature of injection pump of demulsifier
42PT4127 – Pressure of injection pump of demulsifier
42TT4201 – Temperature of injection pump of demulsifier
42FIT4010 – Discharge flow of demulsifier

42PIT4129 – Discharge pressure of demulsifier
42PT4129 – Pressure of injection pump of demulsifier
42TT4202 – Temperature of injection pump of demulsifier
42PT4130 – Pressure of injection pump of demulsifier
42TT4203 – Temperature of injection pump of demulsifier
42FIT4011 – Discharge flow of demulsifier
42PIT4131 – Discharge pressure of demulsifier
42PT4132 – Pressure of injection pump of demulsifier
42TT4204 – Temperature of injection pump of demulsifier
42PT4133 – Pressure of injection pump of demulsifier
42TT4205 – Temperature of injection pump of demulsifier
42FIT4012 – Discharge flow of demulsifier
42PIT4134 – Discharge pressure of demulsifier

Demulsifier Vega

42LT4070 – Level of demulsifier storage tank
42PT4135 – Pressure of injection pump of demulsifier
42TT4206 – Temperature of injection pump of demulsifier
42PT4136 – Pressure of injection pump of demulsifier
42TT4207 – Temperature of injection pump of demulsifier
42FIT4013 – Discharge flow of demulsifier
42PIT4137 – Discharge pressure of demulsifier
42PT4138 – Pressure of injection pump of demulsifier
42TT4208 – Temperature of injection pump of demulsifier
42PT4139 – Pressure of injection pump of demulsifier
42TT4209 – Temperature of injection pump of demulsifier
42FIT4014 – Discharge flow of demulsifier
42PIT4140 – Discharge pressure of demulsifier

Antifoam Gjøa

42LT4071 – Level of Antifoam storage tank
42PT4141 – Pressure of injection pump of Antifoam
42TT4210 – Temperature of injection pump of Antifoam
42PT4142 – Pressure of injection pump of Antifoam
42TT4211 – Temperature of injection pump of Antifoam
42FIT4015 – Discharge flow of Antifoam
42PIT4143 – Discharge pressure of Antifoam

42PT4144 – Pressure of injection pump of Antifoam
42TT4212 – Temperature of injection pump of Antifoam
42PT4145 – Pressure of injection pump of Antifoam
42TT4213 – Temperature of injection pump of Antifoam
42FIT4016 – Discharge flow of Antifoam
42PIT4146 – Discharge pressure of Antifoam
42PT4147 – Pressure of injection pump of Antifoam
42TT4214 – Temperature of injection pump of Antifoam
42PT4148 – Pressure of injection pump of Antifoam
42TT4215 – Temperature of injection pump of Antifoam
42FIT4017 – Discharge flow of Antifoam
42PIT4149 – Discharge pressure of Antifoam

Flocculant Gjøa

42LT4072 – Level of Flocculant storage tank
42PT4150 – Pressure of injection pump of Flocculant
42TT4216 – Temperature of injection pump of Flocculant
42PT4151 – Pressure of injection pump of Flocculant
42TT4217 – Temperature of injection pump of Flocculant
42FIT4018 – Discharge flow of Flocculant
42PIT4152 – Discharge pressure of Flocculant
42PT4153 – Pressure of injection pump of Flocculant
42TT4218 – Temperature of injection pump of Flocculant
42PT4154 – Pressure of injection pump of Flocculant
42TT4219 – Temperature of injection pump of Flocculant
42FIT4019 – Discharge flow of Flocculant
42PIT4155 – Discharge pressure of Flocculant
42PT4156 – Pressure of injection pump of Flocculant
42TT4220 – Temperature of injection pump of Flocculant
42PT4157 – Pressure of injection pump of Flocculant
42TT4221 – Temperature of injection pump of Flocculant
42FIT4020 – Discharge flow of Flocculant
42PIT4158 – Discharge pressure of Flocculant

Oxygen scavenger

42LT4073 – Level of Oxygen scavenger
42PT4159 – Pressure of injection pump of Oxygen scavenger

42TT4222 – Temperature of injection pump of Oxygen scavenger
42PT4160 – Pressure of injection pump of Oxygen scavenger
42TT4223 – Temperature of injection pump of Oxygen scavenger
42FIT4021 – Discharge flow of Oxygen scavenger
42PIT4161 – Discharge pressure of Oxygen scavenger

Biocide Gjøa
42LT4074 – Level of Biocide storage tank
42PT4162 – Pressure of injection pump of Biocide
42TT4224 – Temperature of injection pump of Biocide
42PT4163 – Pressure of injection pump of Biocide
42TT4225 – Temperature of injection pump of Biocide
42FIT4022 – Discharge flow of Biocide
42PIT4164 – Discharge pressure of Biocide

Corrosion Inhibitor Gjøa
42LT4075 – Level of Corrosion inhibitor storage tank
42PT4165 – Pressure of injection pump of Corrosion inhibitor
42TT4226 – Temperature of injection pump of Corrosion inhibitor
42PT4166 – Pressure of injection pump of Corrosion inhibitor
42TT4227 – Temperature of injection pump of Corrosion inhibitor
42FIT4023 – Discharge flow of Corrosion inhibitor
42PIT4167 – Discharge pressure of Corrosion inhibitor

Corrosion Inhibitor Vega
42LT4076 – Level of Corrosion inhibitor storage tank
42PT4168 – Pressure of injection pump of Corrosion inhibitor
42TT4228 – Temperature of injection pump of Corrosion inhibitor
42PT4169 – Pressure of injection pump of Corrosion inhibitor
42TT4229 – Temperature of injection pump of Corrosion inhibitor
42FIT4024 – Discharge flow of Corrosion inhibitor
42PIT4170 – Discharge pressure of Corrosion inhibitor

pH Stabiliser Vega
42LT4077 – Level of pH Stabiliser storage tank
42PT4171 – Pressure of injection pump of pH Stabiliser
42TT4230 – Temperature of injection pump of pH Stabiliser

42PT4172 – Pressure of injection pump of pH Stabiliser

42TT4231 – Temperature of injection pump of pH Stabiliser

42FIT4025 – Discharge flow of pH Stabiliser

42PIT4173 – Discharge pressure of pH Stabiliser

Scale Inhibitor Nova

42LT0037 – Level of scale inhibitor Nova storage tank

42TT1009 – temperature of scale inhibitor Nova storage tank

42PT0038 – Pressure of injection pump A of scale inhibitor

42PT0040 – Pressure of injection pump B of scale inhibitor

42FT0047 – Discharge flow of scale inhibitor

42PST0045 – Discharge pressure of scale inhibitor

42PT0035 – Discharge Pressure of Circulation pump of scale inhibitor

42PDT0046 – Differential Pressure discharge line filters

Asphaltene/Wax Inhibitor Nova

42LT0058 – Level of asphaltene inhibitor Nova storage tank

42TT1010 – Temperature of asphaltene inhibitor Nova storage tank

42PT0060 – Pressure of injection pump A of asphaltene/wax inhibitor

42PT0062 – Pressure of injection pump B of asphaltene/wax inhibitor

42FT0066 – Discharge flow of asphaltene/wax inhibitor

42PST0064 – Discharge pressure of asphaltene/wax inhibitor

42PT0057 – Discharge Pressure of Circulation pump of asphaltene/wax inhibitor

42PDT0065 – Differential Pressure discharge line filters

Corrosion Inhibitor Nova

42LT4079 – Level of Corrosion Inhibitor Nova storage tank

42PT0048 – Pressure of injection pump A of Corrosion inhibitor

42PT0050 – Pressure of injection pump B of Corrosion inhibitor

42FT0053 – Discharge flow of Corrosion inhibitor

42PST0052 – Discharge pressure of Corrosion inhibitor

42PDIT0101 – Differential Pressure discharge line filters of Corrosion inhibitor

Biocide Nova

42LT0001 – Level of biocide Nova storage tank

42TT1011 – Temperature of biocide Nova storage tank

42PT0002 – Pressure of injection pump A of biocide

42PT0004 – Pressure of injection pump B of biocide

42FT0007 – Discharge flow of biocide

42PT0006 – Discharge pressure of biocide

H2S Scavenger Nova

42LT0009 – Level of H2S Scavenger Nova storage tank

42TT1012 – Temperature of H2S Scavenger Nova storage tank

42PT0010 – Pressure of injection pump A of H2S Scavenger

42PT0012 – Pressure of injection pump B of H2S Scavenger

42FT0015 – Discharge flow of H2S Scavenger

42PT0014 – Discharge pressure of H2S Scavenger

Spare and Test tanks

42LIT4078 – Level of test storage tank

42LIT4080 – Level of spare storage tank

42LIT4081 – Level of spare storage tank

42LT0017 – Level of spare storage tank (42TB030)

Chemical spill tank Gjøa/Vega/Duva

42LIT4082 – Level of chemical spill tank

42LIT4083 – Level of chemical spill tank

42LIT4084 – Level of chemical spill tank

42LIT4085 – Level of chemical spill tank

42LIT7031 – Level of chemical spill tanks

Level shall be trended for the last 30 minutes; all other instrumentation shall be trended for the last 5 minutes.

7 INTEGRATED OPERATION

7.1 Preparations in SAS for IO

All the I/O points in system 42 shall be integrated with the IMS server (data collector) which is the gateway for SAS information system. All the data for system 42 shall be entering into SAS node and also available in the IMS.

7.2 Special software applications for IO tasks

NA

8 HARDWARE IMPLEMENTATION

8.1 System overview

Scale inhibitor A/B/C Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Scale inhibitor A/B Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Wax Inhibitor A/B Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Wax Inhibitor A/B Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Wax Inhibitor Duva is connected to node C11 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C11, L04 and L06 is in fault condition.

Demulsifier Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Demulsifier Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Antifoam Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Flocculant Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Oxygen scavenger Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Biocide Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Corrosion Inhibitor Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Corrosion Inhibitor Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

pH Stabiliser Gjøa is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Scale inhibitor Nova is connected to node C16 and the pumps are connected to L20 and L21. This system doesn't have any back-up, if either of the nodes C16, L20 and L21 is in fault condition.

Asphaltene/Wax inhibitor Nova is connected to node C16 and the pumps are connected to L20 and L21. This system doesn't have any back up, if either of the nodes C16, L20 and L21 is in fault condition.

Corrosion Inhibitor Nova is connected to node C10 and C16. The pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, C16, L04 and L06 is in fault condition.

Biocide Nova is connected to node C16 and the pumps are connected to L20 and L21. This system doesn't have any back up, if either of the nodes C16, L20 and L21 is in fault condition.

H2S Scavenger Nova is connected to node C16 and the pumps are connected to L20 and L21. This system doesn't have any back up, if either of the nodes C16, L20 and L21 is in fault condition.

Spare & Test tanks Gjøa/Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

Chemical spill tanks Gjøa/Vega is connected to node C10 and the pumps are connected to L04 and L06. This system doesn't have any back-up, if either of the nodes C10, L04 and L06 is in fault condition.

8.2 Rio and interaction with local panels and other systems

All the instrumentation in chemical injection system is tied –up with RIO cabinets 87JF762V, 87JF762W and 87JF762N, node C10 with exception of Scale inhibitor Nova, Asphaltene/wax inhibitor Nova, H2S Scavenger Nova, Biocide Nova instrumentation which is tied-up with RIO cabinet 87JF802A, 87JF802B, node C16. All Corrosion Inhibitor Nova instrumentation is tied-up with RIO cabinet 87JF802A, 87JF802B, node C16 except instrumentation installed on existing chemical spare tank 42TB010 that will be used for Corrosion Inhibitor storage tank will still be tied-up with RIO cabinets 87JF762V node C10. Duva chemical injection instrumentation is tie-up with RIO cabinets 87JF762F and 87JF784F

The following pumps are connected to 690V Switchboard A Process 82EN400A.

42PA001, 42PD001A, 42PD002A, 42PD003A, 42PD016A, 42PD017A, 42PD051A, 42PA059, 42PD059A, 42PD005A, 42PD018A, 42PA055, 42PD055A, 42PD006A, 42PD009A, 42PD020A, 42PD053A, 42PD060A, 42PD007A, 42PD023A, 42PD024A, 42PD004A, 42PD021A, 42PD022A, 42PD014A, 42PD008A, 42PD015A, 42PD052A, 42PD054A, 42PD701A, 42PA701, 42PD010A.

The following pumps are connected to 690V Switchboard B Process 82EN400B.

42PD001B, 42PD002B, 42PD003B, 42PD016B, 42PD017B, 42PD051B, 42PD059B, 42PD005B, 42PD018B, 42PD055B, 42PD006B, 42PD009B, 42PD020B, 42PD053B, 42PD060B, 42PD007B, 42PD023B, 42PD024B, 42PD004B, 42PD021B, 42PD022B, 42PD014B, 42PD008B, 42PD015B, 42PD052B, 42PD054B, 42PD701B, 42FE701, 42PD010B.

The following pumps are connected to 690V Switchboard A Process 82EN800A.

42PD027A, 42PD028A, 42PD013A, 42PD029A and 42PA002.

The following pumps are connected to 690V Switchboard B Process 82EN800B.

42PD027B, 42PD028B, 42PD013B, 42PD029B and 42PA003.

8.3 Special instrumentation

NA

9 REFERENCES

9.1 Functional Specifications:

Doc. number	Doc. Title
C097-AKG-J-RA-0100	SAS Functional Spec. for Alarm system 87
C097-AKG-J-RA-8720	SAS FUNCTIONAL SPECIFICATION, SYSTEM 87P, PROCESS SHUTDOWN SYSTEM
C097-AKG-J-RA-8002	SAS FUNCTIONAL SPECIFICATION FOR SYSTEM 80, 82, 83, 84, 85 - PDCS
C097-RWP-P-FD-0001	CONTROL PHILOSOPHY NOVA TIE IN

9.2 Interface Specifications:

Doc. number	Doc. Title
C097-AKG-J-SA-8706	Package interface specification for oil export Mongstad

9.3 System Manuals:

Doc. number	Doc. Title
C097-ANG-J-SA-0001	SAS Functional Spec. for System 87

9.4 P&IDs/D&IDs:

Doc. number	Doc. Title
C097-AKG-P-XB-4201-01	TOTE TANK LAYDOWN AREA PART 1
C097-AKG-P-XB-4202-01	TOTE TANK LAYDOWN AREA PART 2
C097-AKG-P-XB-4203-01	TOTE TANK LAYDOWN AREA PART 3
C097-AKG-P-XB-4229-01	CHEMICAL INJECTION PACKAGE PART 1
C097-AKG-P-XB-4230-01	CHEMICAL INJECTION PACKAGE PART 2
C097-AKG-P-XB-4231-01	CHEMICAL INJECTION PACKAGE PART 3
C097-AON-P-XB-0001-01 to 31	VENDOR P&ID's CHEMICAL INJECTION SYSTEM
C097-AON-R-XC-4201-01	D&ID (HVAC) GJØA
C097-RWP-P-XB-4211-01	UTILITY P&ID DUVA CHEMICAL INJECTION PACKAGE
C097-RWP-P-XB-4216-01	UTILITY P&ID DUVA WAX INHIBITOR HOSE LOADING
C097-AKG-P-XB-4241-01	UTILITY P&ID SCALE INHIBITOR A 42PD001A/B GJØA
C097-AKG-P-XB-4242-01	UTILITY P&ID SCALE INHIBITOR B 42PD001A/B GJØA

Doc. number	Doc. Title
C097-AKG-P-XB-1902-01	UTILITY P&ID UMBILICAL INTERFACE GJØA
C097-CRE-P-XB-0001-02	VENDOR PROCESS & INSTRUMENT P&ID, DUVA LDHI
C097-CRE-P-XB-0001-03	VENDOR PROCESS & INSTRUMENT P&ID, DUVA WAX INHIBITOR SPILL TANK
C097-CRE-P-XB-0001-04	VENDOR PROCESS & INSTRUMENT P&ID, DUVA LDHI SPILL TANK
C097-CRE-P-XB-4212-01	VENDOR PROCESS & INSTRUMENT P&ID, DUVA WAX INHIBITOR SYSTEM
C097-CRE-P-XB-4213-01	VENDOR PROCESS & INSTRUMENT P&ID, DUVA WAX INHIBITOR SPILL TANK
C097-CRE-P-XB-4214-01	VENDOR PROCESS & INSTRUMENT P&ID, DUVA LDHI INHIBITOR
C097-CRE-P-XB-4215-01	VENDOR PROCESS & INSTRUMENT P&ID, DUVA LDHI SPILL TANK
C097-HIP-P-XB-4204-01	Chemicals Injection Unit - Scale Inhibitor System P&ID
C097-HIP-P-XB-4205-01	Chemicals Injection Unit - Corrosion Inhibitor System P&ID
C097-HIP-P-XB-4206-01	Chemicals Injection Unit - H2S Scavenger System P&ID
C097-HIP-P-XB-4207-01	Chemicals Injection Unit - Biocide System P&ID
C097-HIP-P-XB-4208-01	Chemicals Injection Unit - Spare Tank & Washing System P&ID
C097-HIP-P-XB-4209-01	Chemicals Injection Unit - Asphaltene/ Wax Dispersant System P&ID
C097-RWP-P-XB-4205-01	UTILITY P&ID NOVA CORROSION INHIBITOR 42PD010A/B
C097-RWP-P-XB-4210-01	UTILITY P&ID NOVA CHEMICAL INJECTION SKID

9.5 I/O listing

Doc. number	Doc. Title
C097-AKG-J-LA-4201	Hardware KESYS report System 42 Chemical Injection

9.6 Miscellaneous

Doc. number	Doc. Title
C097-AKE-J-FD-0005	Alarm System Specification
C097-AKG-J-KA-0001	Alarm system development procedure
C097-AKG-J-LA-8703	OPC list for load calculator

Doc. number	Doc. Title
C097-AKG-J-RA-0100	SAS functional specification system 87 alarm system
C097-AON-R-XR-0001-01	CAUSE & EFFECT CHART

10 ATTACHMENTS

The content of this FS must be read together with following attachments. These documents and the FS forms the complete description of the functional requirements for this system.

10.1 SCD:

Doc. Number	Doc. Title
C097-AKG-J-XL-4201-01	SCALE INHIBITOR A Gjøa
C097-AKG-J-XL-4202-01	SCALE INHIBITOR B Gjøa
C097-AKG-J-XL-4203-01	SCALE INHIBITOR C Gjøa
C097-AKG-J-XL-4204-01	SCALE INHIBITOR A Vega
C097-AKG-J-XL-4205-01	SCALE INHIBITOR B Vega
C097-AKG-J-XL-4206-01	WAX INHIBITOR Gjøa
C097-AKG-J-XL-4207-01	WAX INHIBITOR Vega
C097-AKG-J-XL-4208-01	DEMULSIFIER Gjøa
C097-AKG-J-XL-4209-01	DEMULSIFIER Vega
C097-AKG-J-XL-4210-01	ANITFOAM Gjøa
C097-AKG-J-XL-4211-01	FLOCCULANT Gjøa
C097-AKG-J-XL-4212-01	OXYGEN SCAVENGER Gjøa
C097-AKG-J-XL-4213-01	BIOCIDE Gjøa
C097-AKG-J-XL-4214-01	CORROSION INHIBITOR Gjøa
C097-AKG-J-XL-4215-01	CORROSION INHIBITOR Vega
C097-AKG-J-XL-4216-01	pH STABILISER Vega
C097-AKG-J-XL-4217-01	SPARE AND TEST TANKS Gjøa/Vega
C097-AKG-J-XL-4218-01	CHEMICAL SPILL TANKS Gjøa/Vega
C097-AKG-J-XL-1301-01	SCD GJØA PRODUCTION GAS FLOWLINE
C097-AKG-J-XL-1312-01	SCD GJØA PRODUCTION OIL FLOWLINE
C097-RWP-J-XL-4224-01	DUVA WAX/LDHI INHIBITOR
C097-RWP-J-XL-4225-01	DUVA CHEMICAL INJECTION SYSTEM
C097-AKG-J-XL-4217-01	SCD, SPARE AND TEST TANKS, GJOA/VEGA
C097-RWP-J-XL-1903-01	SCD, NOVA UMBILICAL INTERFACE
C097-RWP-J-XL-4219-01	SCD, SCALE INHIBITOR NOVA

Doc. Number	Doc. Title
C097-RWP-J-XL-4220-01	SCD, ASPHALTENE/WAX INHIBITOR NOVA
C097-RWP-J-XL-4221-01	SCD, CORROSION INHIBITOR NOVA
C097-RWP-J-XL-4222-01	SCD, BIOCIDE, NOVA
C097-RWP-J-XL-4223-01	SCD, H2S SCAVENGER, NOVA
C097-RWP-J-XL-4230-01	SCD, CHEMICAL INJECTION PACKAGE OUTGOING LINES, NOVA

10.2 Control sequence

Doc. Number	Doc. Title

10.3 Cause & Effects

Doc. Number	Doc. Title
C097-AKG-J-XR-4201-01	Context & Hiding diagram System 42
C097-RWP-J-XR-8701-140	SAS CAUSE & EFFECT FOR SYSTEM 87 PSD 5.42.5
C097-AON-R-XR-001-01	CAUSE & EFFECT DIAGRAM SYSTEM 42
C097-HIP-J-XR-0001-01	Cause & Effect PCS 42XR002 Scale Inhibitor System
C097-HIP-J-XR-0001-02	Cause & Effect PCS 42XR002 H2S Scavenger System
C097-HIP-J-XR-0001-03	Cause & Effect PCS 42XR002 Biocide System
C097-HIP-J-XR-0001-04	Cause & Effect PCS 42XR002 Spare Tank System
C097-HIP-J-XR-0001-05	Cause & Effect PCS 42XR002 Asphaltene/Wax Disp. System
C097-HIP-J-XR-0001-07	Cause & Effect PCS 42XR003 Corrosion Inhibitor System
C097-AKG-J-XR-8701-135	SAS Cause & Effect Diagram for System 87 P5.42.1
C097-AKG-J-XR-8701-136	SAS Cause & Effect Diagram for System 87 P5.42.2
C097-AKG-J-XR-8701-137	SAS Cause & Effect Diagram for System 87 P5.42.3
C097-AKG-J-XR-8701-138	SAS Cause & Effect Diagram for System 87 P5.42.4
C097-AKG-J-XR-7901-06	ESD CAUSE & EFFECT DIAGRAM NAS2 (2/2)

10.4 VDU pictures:

Doc. number	Doc. title
MM-AKG-GJO-00604	MTO Review meeting for chemical injection system
MM-AKG-GJO-00651	HF: 2nd meeting reviewing chemical injection system (42) displays
C097-ANG-J-ZD-0002	HMI SAS PCS