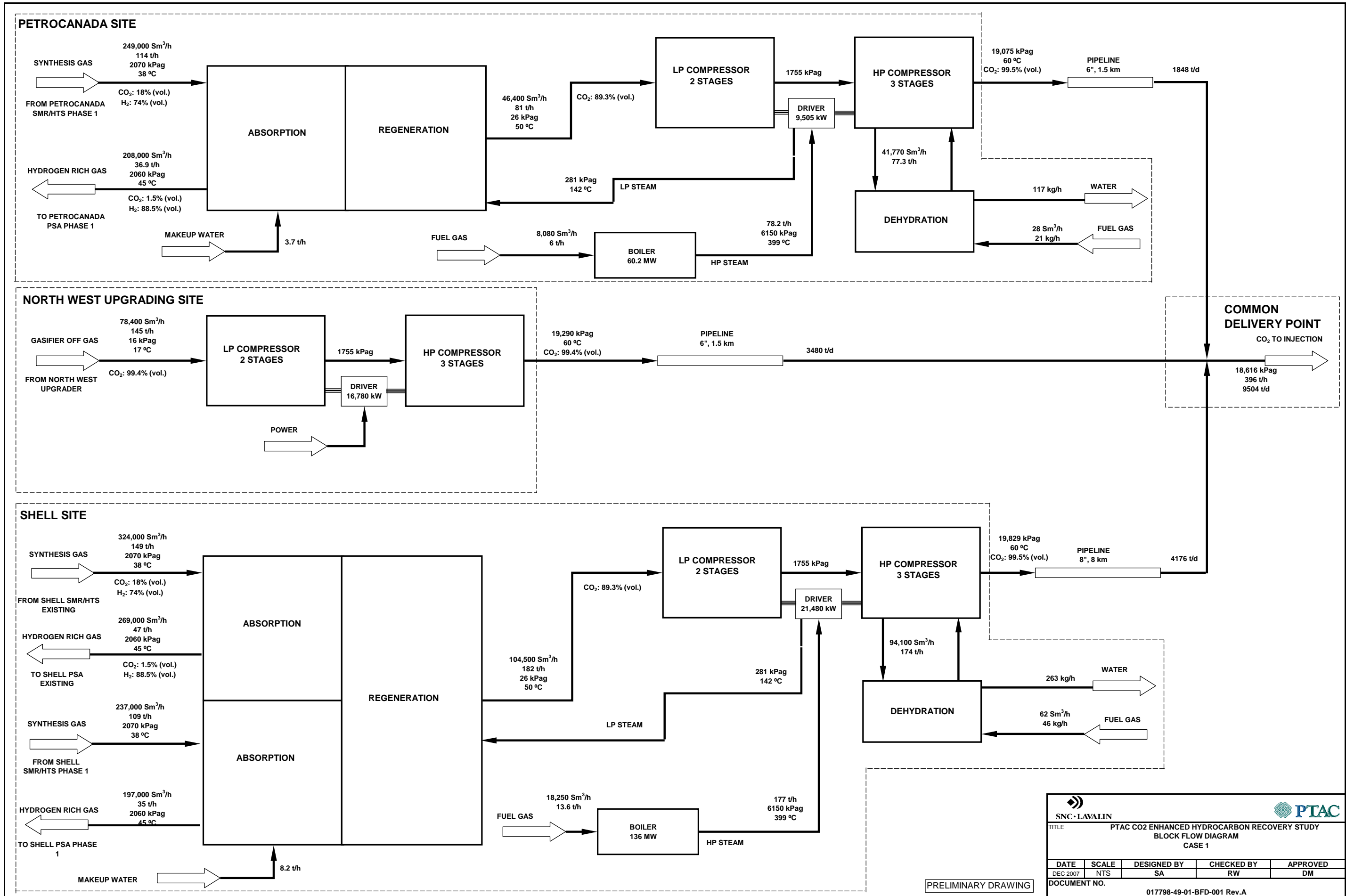




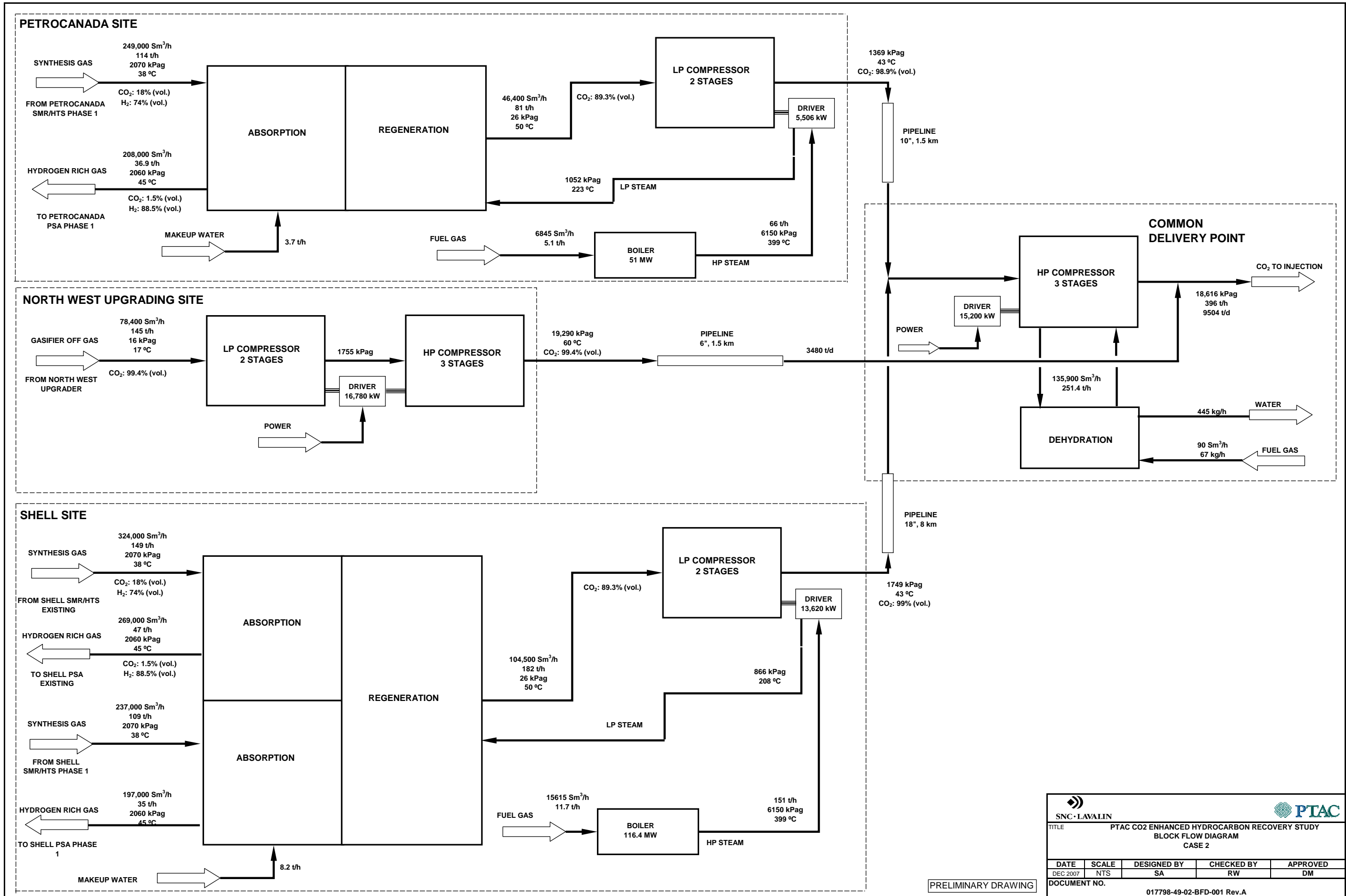
SNC • LAVALIN

Appendix 4
Technical Design Parameters and Drawings



SNC-LAVALIN		PTAC	
TITLE: PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY BLOCK FLOW DIAGRAM CASE 1			
DATE	SCALE	DESIGNED BY	CHECKED BY
DEC 2007	NTS	SA	RW
APPROVED		DM	
DOCUMENT NO. 017798-49-01-BFD-001 Rev.A			

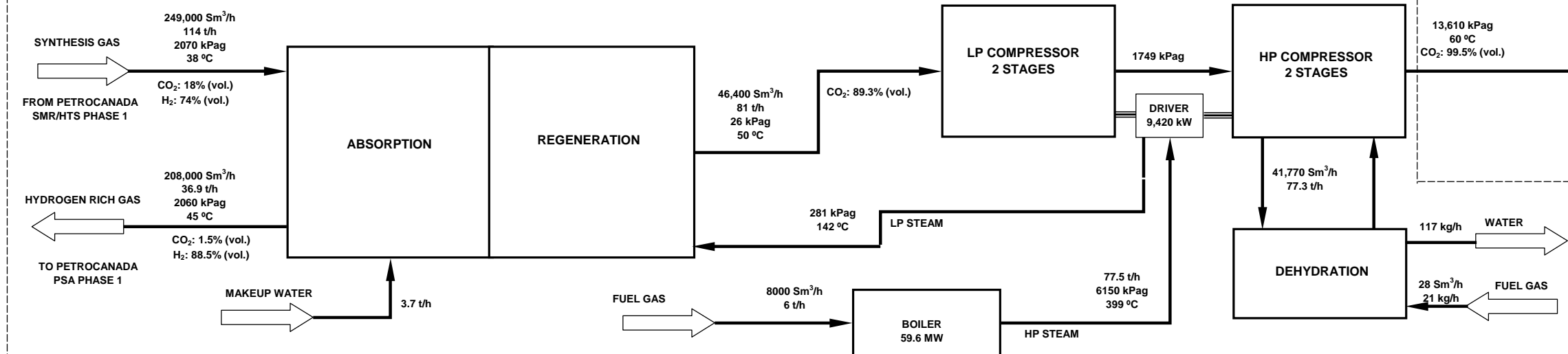
PRELIMINARY DRAWING



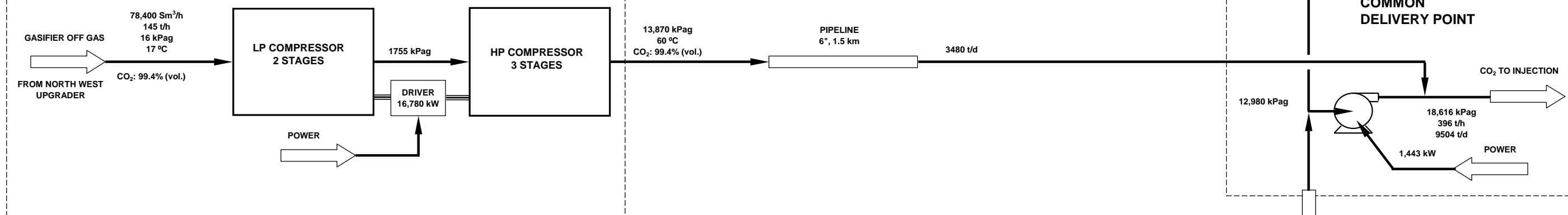
PRELIMINARY DRAWING

TITLE: PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY BLOCK FLOW DIAGRAM CASE 2				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
DEC 2007	NTS	SA	RW	DM
DOCUMENT NO.				017798-49-02-BFD-001 Rev.A

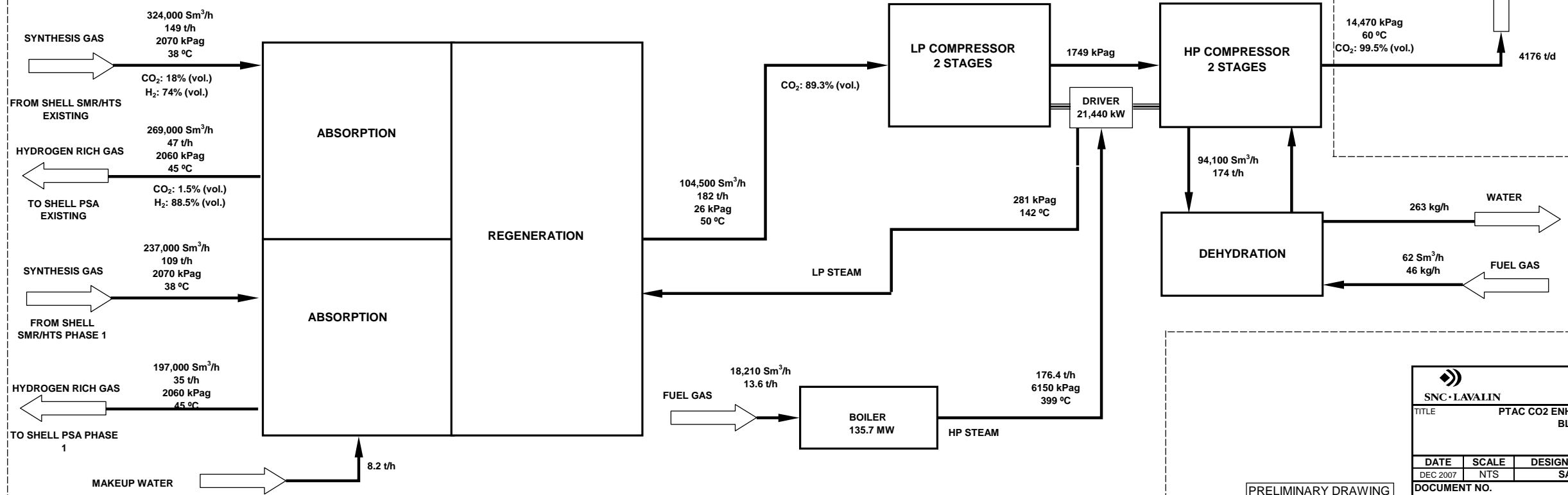
PETROCANADA SITE



NORTH WEST UPGRADING SITE

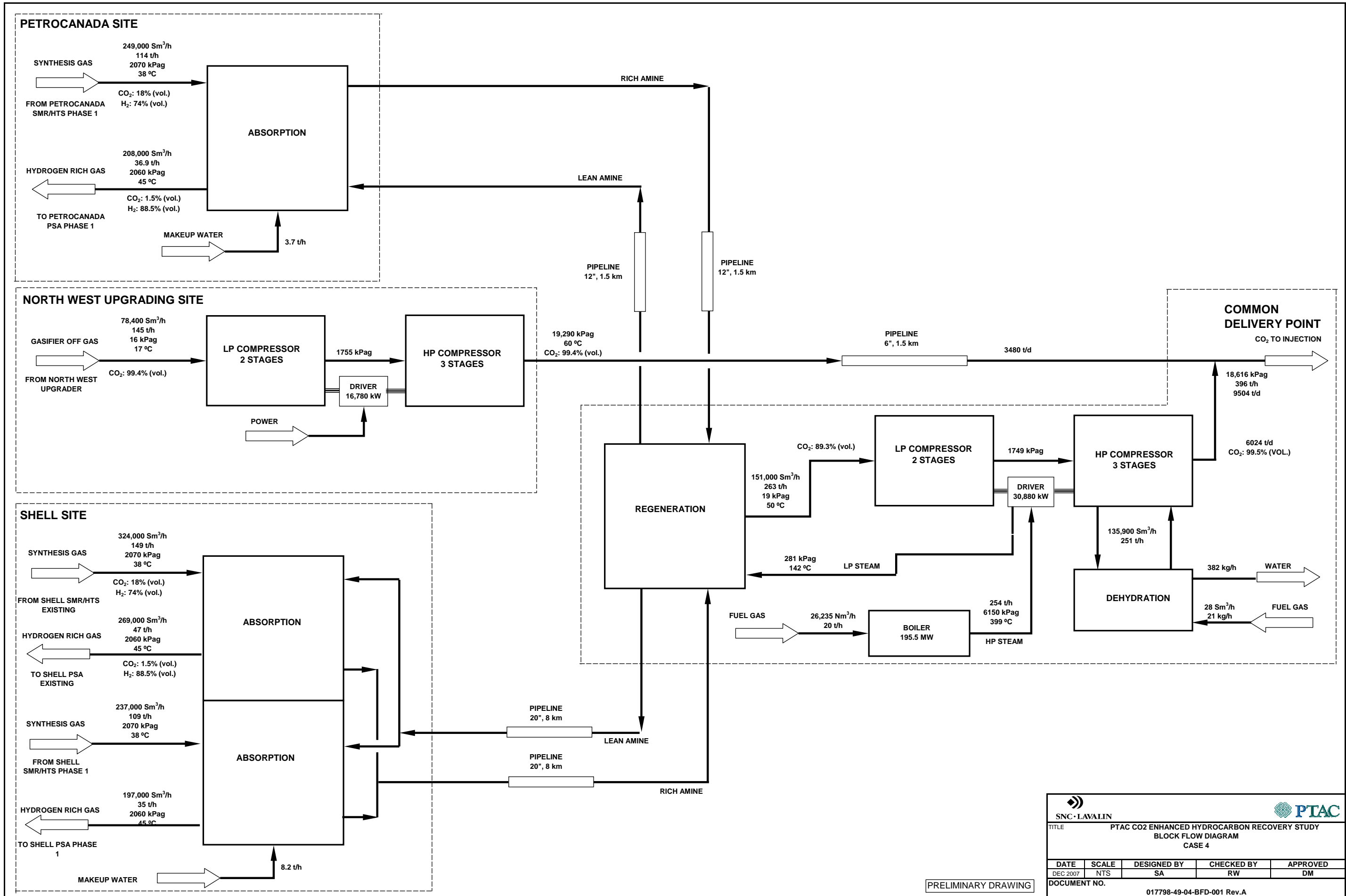


SHELL SITE



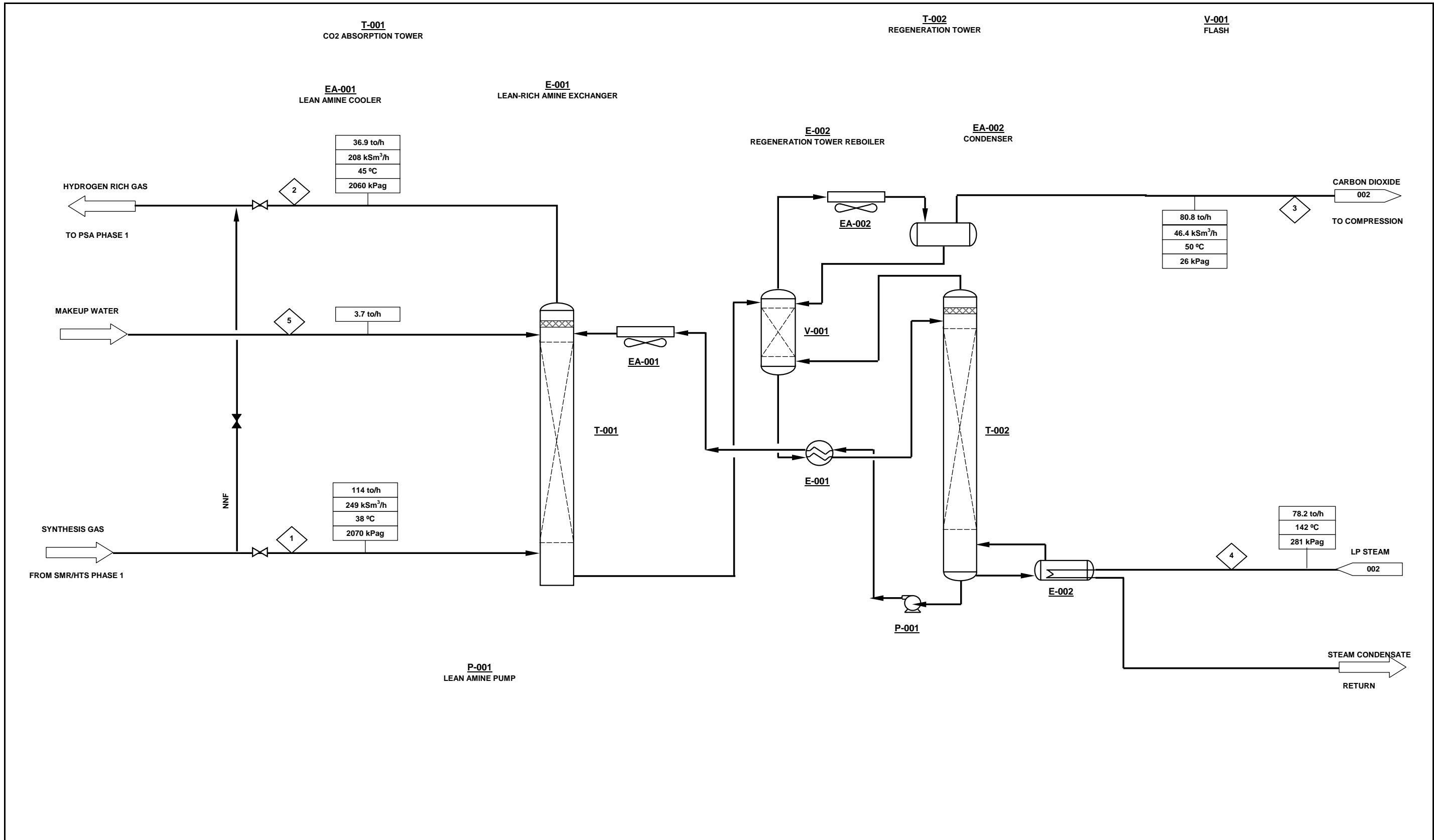
PRELIMINARY DRAWING

SNC-LAVALIN		PTAC	
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY BLOCK FLOW DIAGRAM CASE 3			
DATE	SCALE	DESIGNED BY	CHECKED BY
DEC 2007	NTS	SA	RW
APPROVED		DM	
DOCUMENT NO. 017798-49-03-BFD-001 Rev.A			



PRELIMINARY DRAWING

TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY BLOCK FLOW DIAGRAM CASE 4				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
DEC 2007	NTS	SA	RW	DM
DOCUMENT NO.				017798-49-04-BFD-001 Rev.A



T-001
CO2 ABSORPTION TOWER

T-002
REGENERATION TOWER

V-001
FLASH

EA-001
LEAN AMINE COOLER

E-001
LEAN-RICH AMINE EXCHANGER

E-002
REGENERATION TOWER REBOILER

EA-002
CONDENSER

HYDROGEN RICH GAS

TO PSA PHASE 1

MAKEUP WATER

SYNTHESIS GAS

FROM SMR/HTS PHASE 1

NNF

CARBON DIOXIDE

TO COMPRESSION

LP STEAM

STEAM CONDENSATE

RETURN

36.9 to/h
208 kSm³/h
45 °C
2060 kPag

3.7 to/h

114 to/h
249 kSm³/h
38 °C
2070 kPag

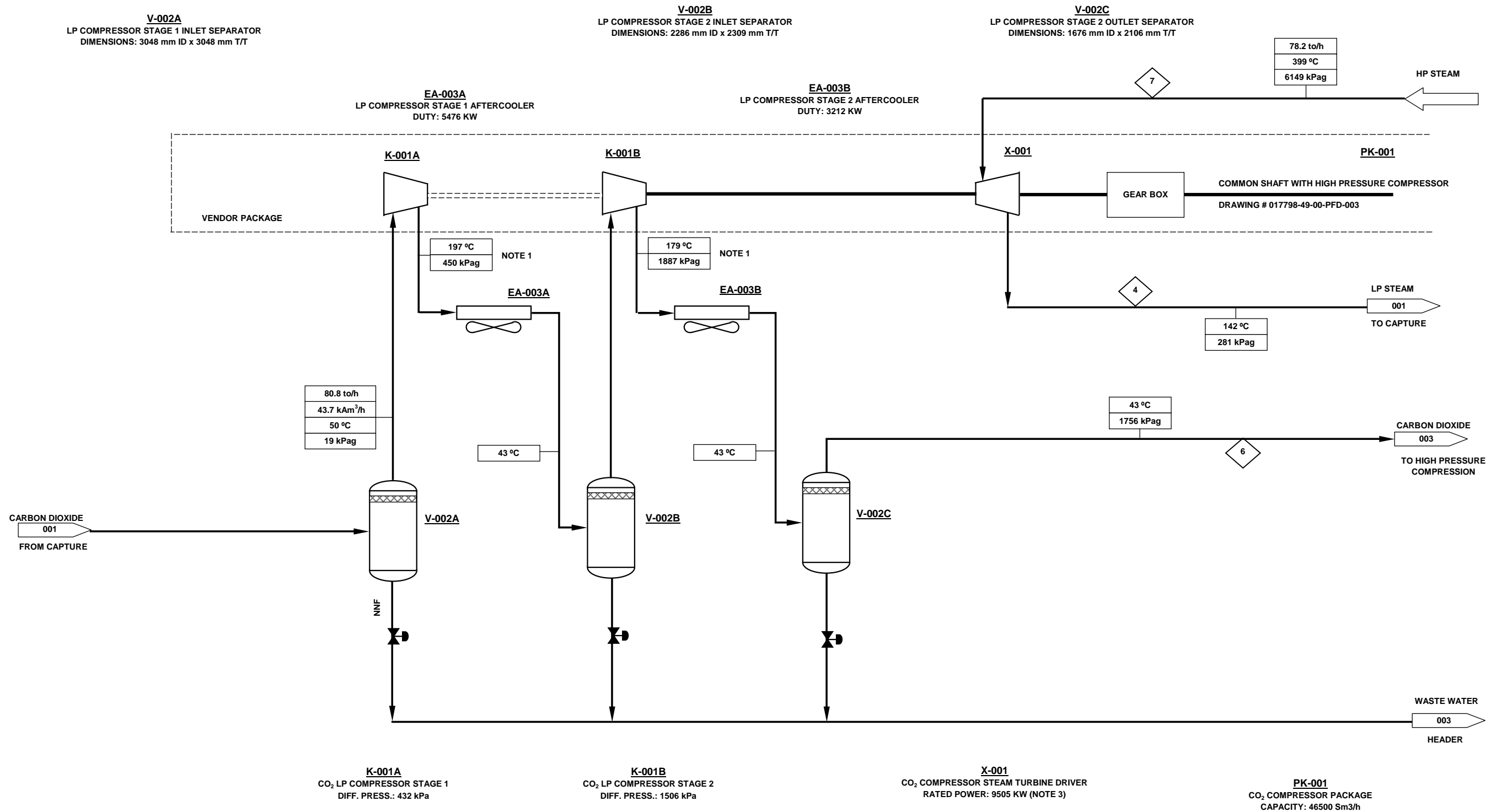
80.8 to/h
46.4 kSm³/h
50 °C
26 kPag

78.2 to/h
142 °C
281 kPag

NOTES:
1. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

SNC-LAVALIN		PTAC	
TITLE PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM PETROCANADA UPGRADER PHASE 1 CARBON DIOXIDE CAPTURE			
DATE	SCALE	DESIGNED BY	CHECKED BY
NOV 2007	NTS	SA	RW
APPROVED		DM	
DOCUMENT NO. 017798-49-01-PFD-001 Rev.A			

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION



NOTES:
 1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES
 3. RATED POWER INCLUDES ESTIMATED 3% POWER LOSS. ACTUAL RATED POWER BY VENDOR

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

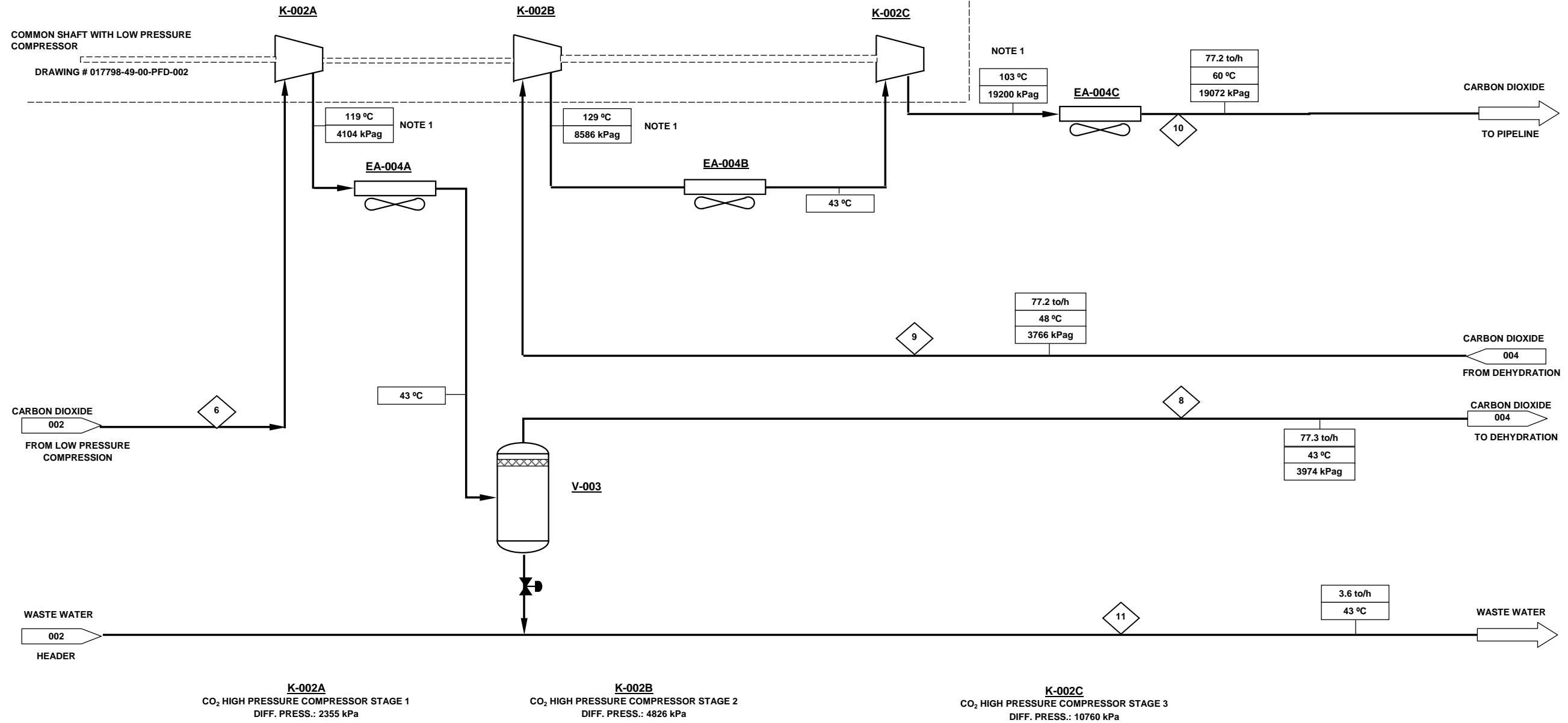
SNC-LAVALIN		PTAC		
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM PETROCANADA UPGRADER PHASE 1 CARBON DIOXIDE LOW PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-002 Rev. A				

V-003
 HP COMPRESSOR STAGE 1 OUTLET SEPARATOR
 DIMENSIONS: 1372 mm ID x 2030 mm T/T

EA-004A
 HP COMPRESSOR STAGE 1 AFTERCOOLER
 DUTY: 1846 KW

EA-004B
 HP COMPRESSOR STAGE 2 AFTERCOOLER
 DUTY: 3191 KW

EA-004C
 HP COMPRESSOR STAGE 3 AFTERCOOLER
 DUTY: 2297 KW

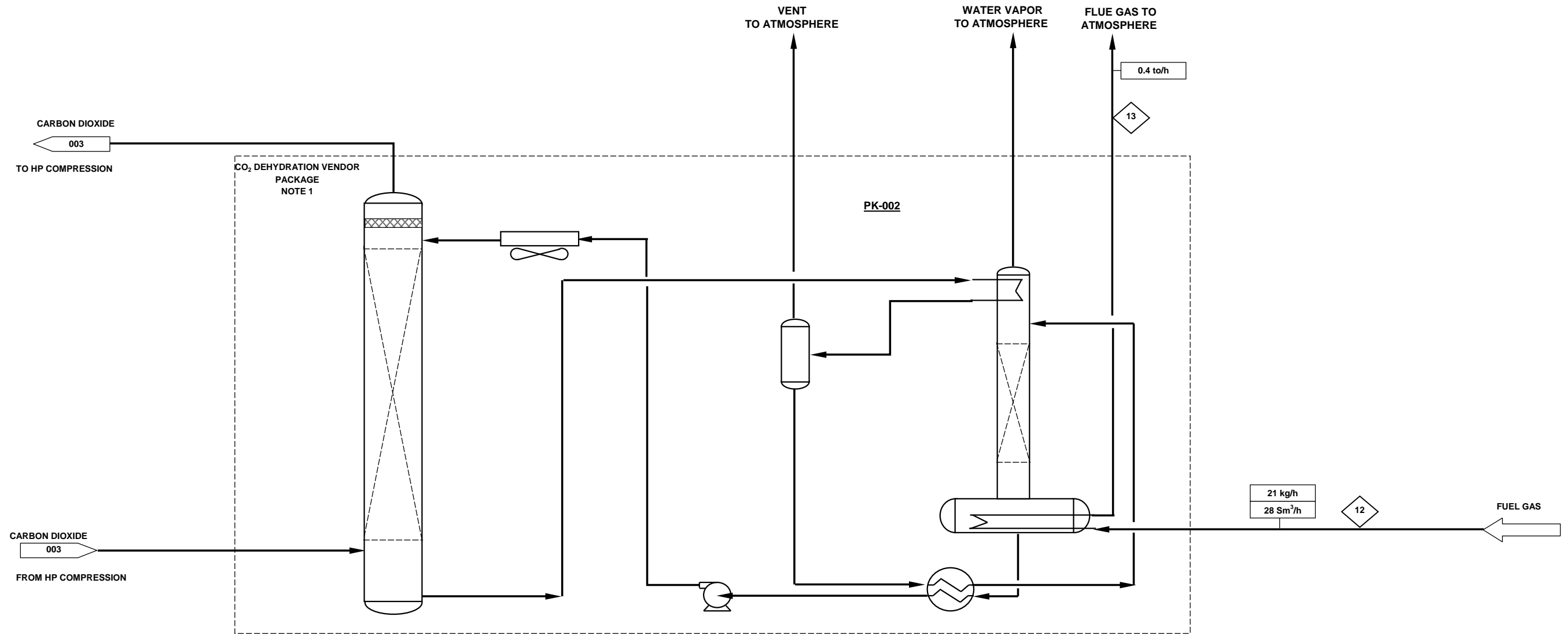


NOTES:
 1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

SNC-LAVALIN		PTAC		
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM PETROCANADA UPGRADER PHASE 1 CARBON DIOXIDE HIGH PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-003 Rev. A				

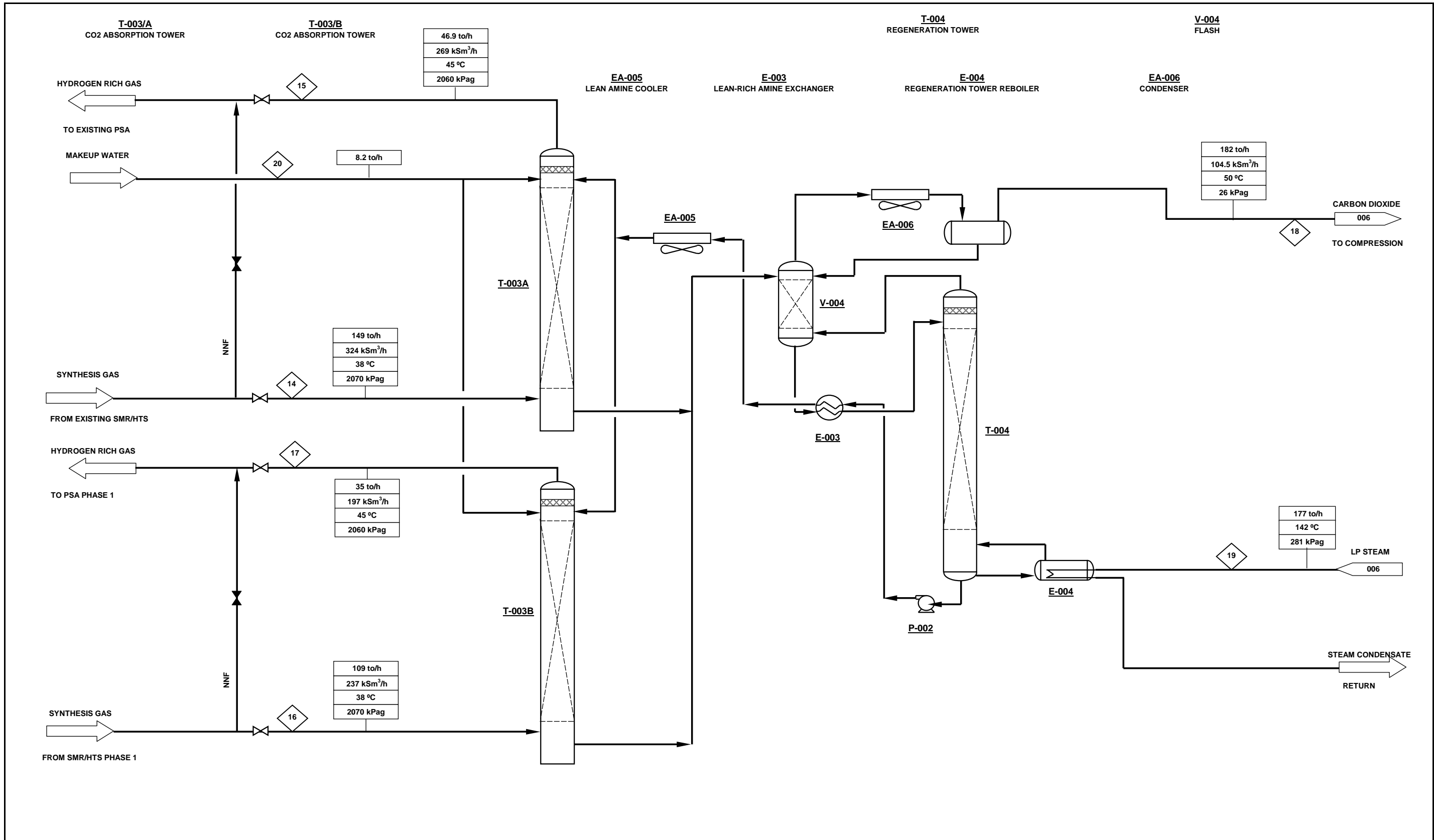
PK-002
CO2 DEHYDRATION PACKAGE
CAPACITY: 1853 TPD (DRY CO2)



NOTES:
 1. VENDOR PACKAGE INTERNAL CONFIGURATION IS FOR INFORMATION ONLY. THE ACTUAL CONFIGURATION MAY BE DIFFERENT.
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

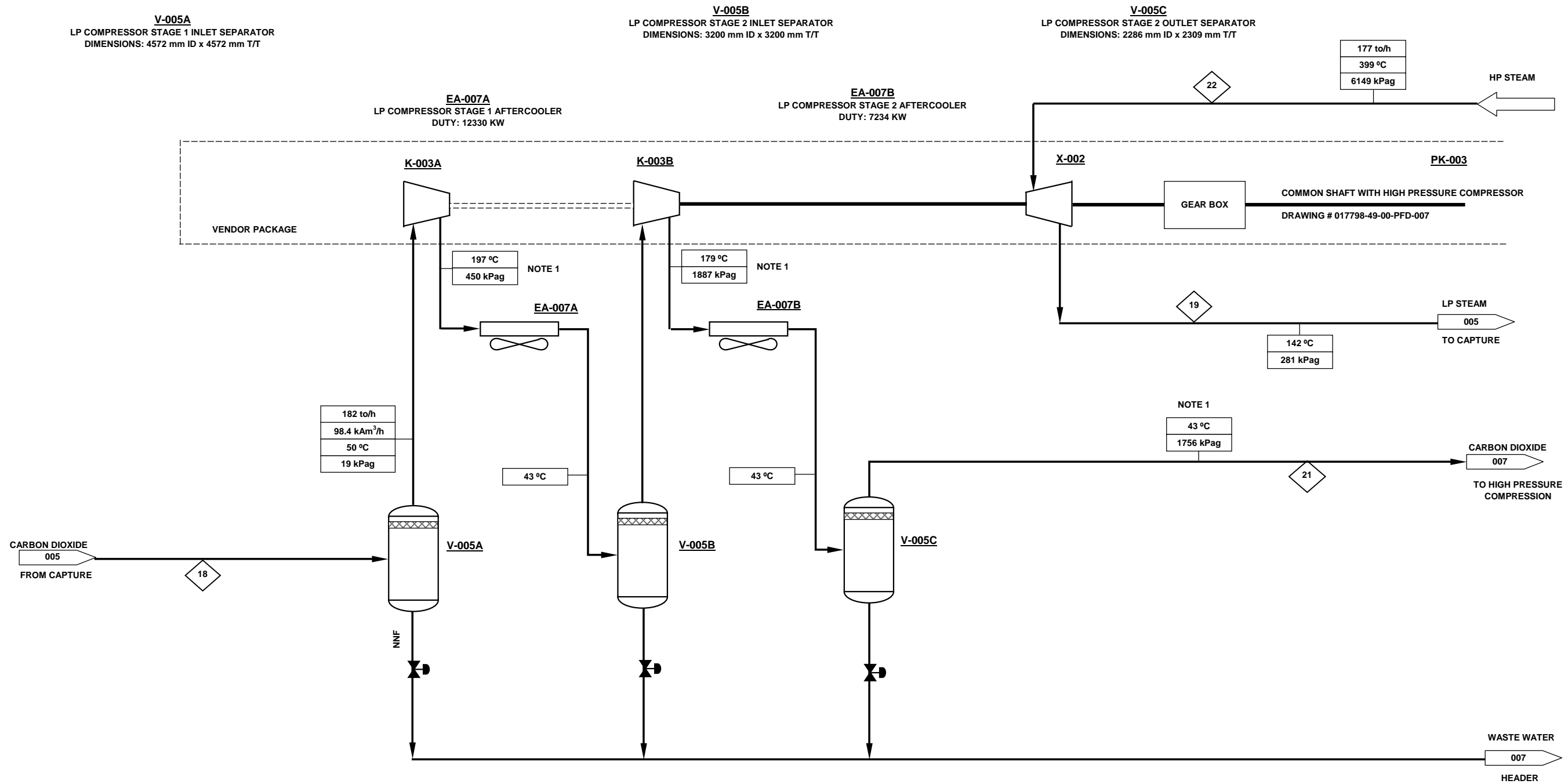
TITLE: PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM PETROCANADA UPGRADER PHASE 1 CARBON DIOXIDE DEHYDRATION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-004 Rev. A				



NOTES:
 1. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

TITLE PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY PROCESS FLOW DIAGRAM SHELL EXISTING AND PHASE 1 UPGRADERS CARBON DIOXIDE CAPTURE				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO.				017798-49-01-PFD-005 Rev.A



V-005A
 LP COMPRESSOR STAGE 1 INLET SEPARATOR
 DIMENSIONS: 4572 mm ID x 4572 mm T/T

V-005B
 LP COMPRESSOR STAGE 2 INLET SEPARATOR
 DIMENSIONS: 3200 mm ID x 3200 mm T/T

V-005C
 LP COMPRESSOR STAGE 2 OUTLET SEPARATOR
 DIMENSIONS: 2286 mm ID x 2309 mm T/T

EA-007A
 LP COMPRESSOR STAGE 1 AFTERCOOLER
 DUTY: 12330 KW

EA-007B
 LP COMPRESSOR STAGE 2 AFTERCOOLER
 DUTY: 7234 KW

VENDOR PACKAGE

K-003A

K-003B

X-002

PK-003

GEAR BOX

COMMON SHAFT WITH HIGH PRESSURE COMPRESSOR
 DRAWING # 017798-49-00-PFD-007

197 °C
 450 kPag
 NOTE 1

179 °C
 1887 kPag
 NOTE 1

177 to/h
 399 °C
 6149 kPag

HP STEAM

43 °C

43 °C

142 °C
 281 kPag

LP STEAM
 005
 TO CAPTURE

182 to/h
 98.4 kAm³/h
 50 °C
 19 kPag

NOTE 1
 43 °C
 1756 kPag

CARBON DIOXIDE
 007
 TO HIGH PRESSURE
 COMPRESSION

CARBON DIOXIDE
 005
 FROM CAPTURE

WASTE WATER
 007
 HEADER

K-003A
 CO₂ LP COMPRESSOR STAGE 1
 DIFF. PRESS.: 432 kPa

K-003B
 CO₂ LP COMPRESSOR STAGE 2
 DIFF. PRESS.: 1506 kPa

X-002
 CO₂ COMPRESSOR STEAM TURBINE DRIVER
 RATED POWER: 21480 KW (NOTE 3)

PK-003
 CO₂ COMPRESSOR PACKAGE
 CAPACITY: 104600 Sm³/h

- NOTES:
 1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES
 3. RATED POWER INCLUDES ESTIMATED _ KW POWER LOSS. ACTUAL RATED POWER BY VENDOR

SNC-LAVALIN		PTAC		
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM SHELL EXISTING AND PHASE 1 UPGRADE CARBON DIOXIDE LOW PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO.				017798-49-01-PFD-006 Rev. A

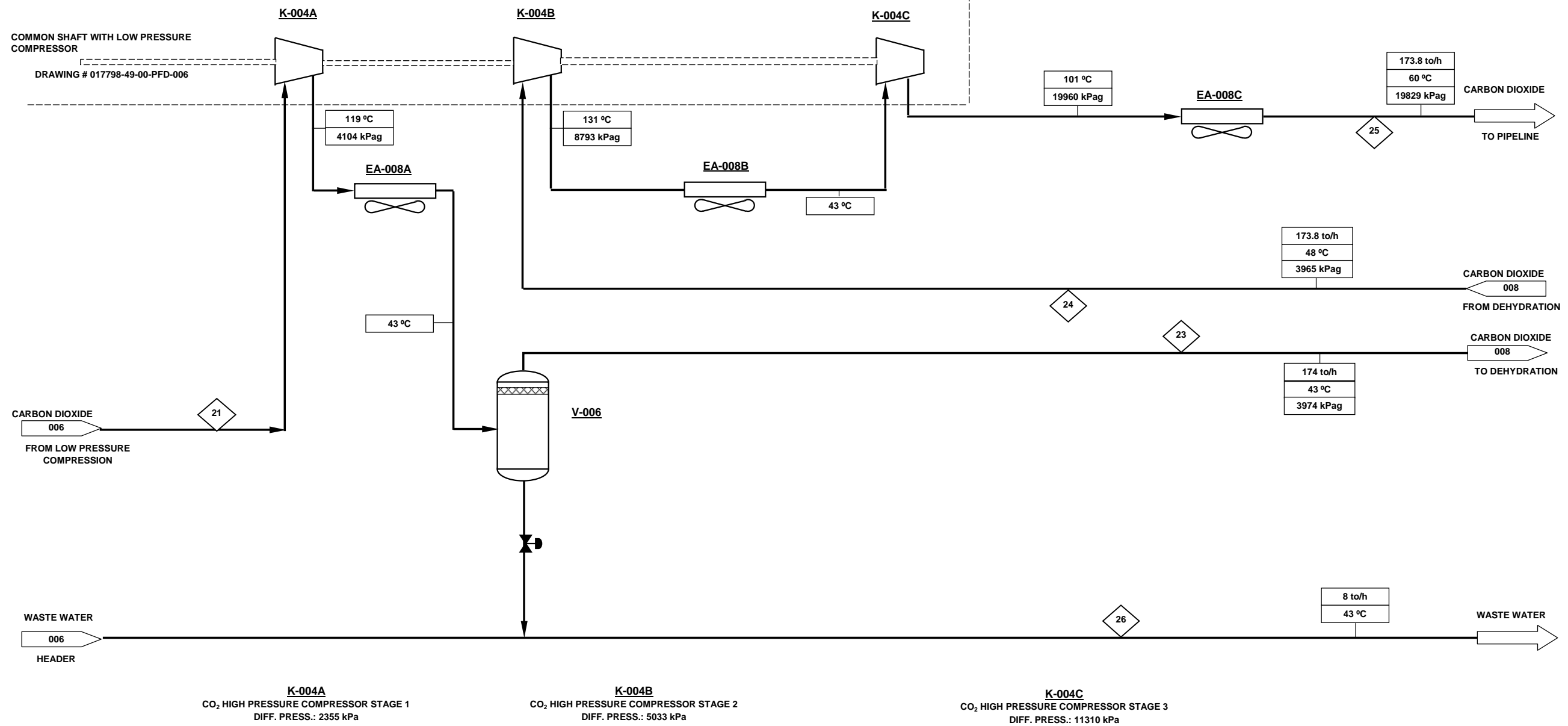
PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

V-006
 HP COMPRESSOR STAGE 1 OUTLET SEPARATOR
 DIMENSIONS: 1981 mm ID x 2182 mm T/T

EA-008A
 HP COMPRESSOR STAGE 1 AFTERCOOLER
 DUTY: 4157 KW

EA-008B
 HP COMPRESSOR STAGE 2 AFTERCOOLER
 DUTY: 7623 KW

EA-008C
 HP COMPRESSOR STAGE 3 AFTERCOOLER
 DUTY: 4945 KW

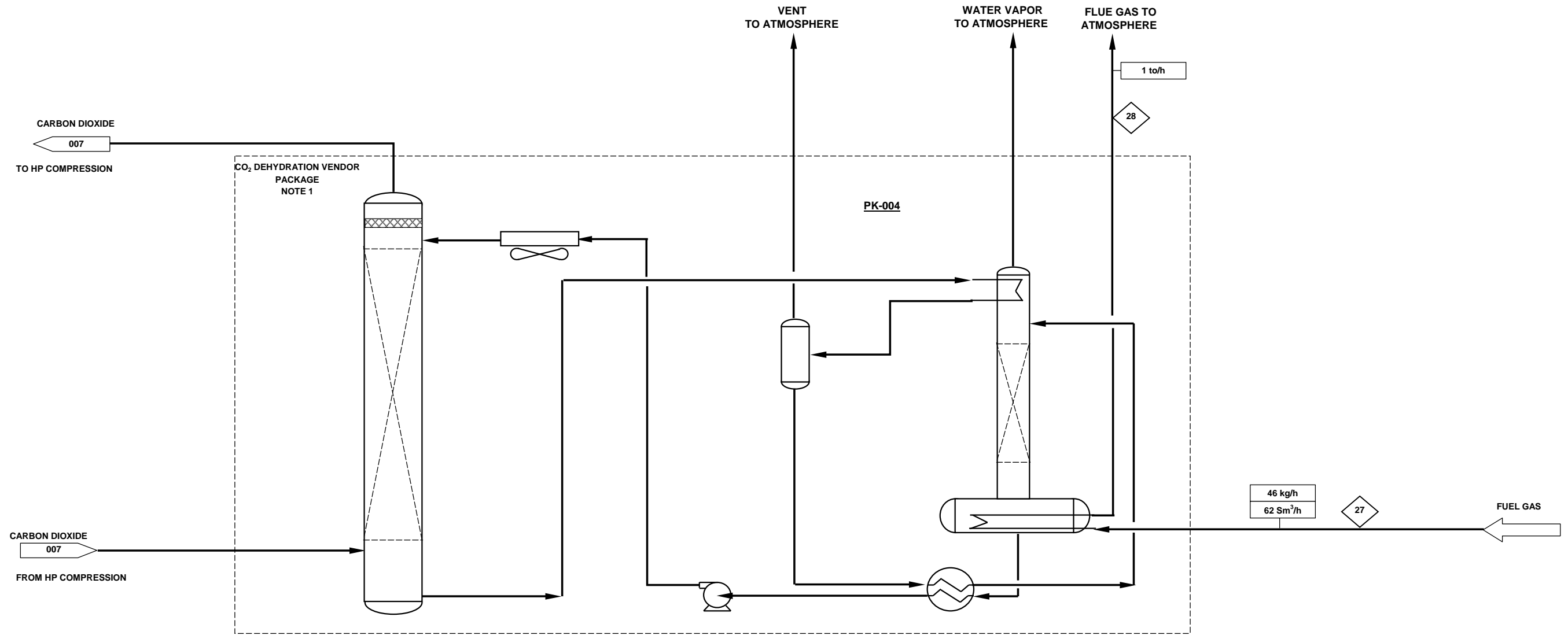


NOTES:
 1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

SNC-LAVALIN		PTAC		
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM SHELL EXISTING AND PHASE 1 UPGRADERS CARBON DIOXIDE HIGH PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-007 Rev. A				

PK-004
CO2 DEHYDRATION PACKAGE
CAPACITY: 4171 TPD (DRY CO2)



- NOTES:
 1. VENDOR PACKAGE INTERNAL CONFIGURATION IS FOR INFORMATION ONLY. THE ACTUAL CONFIGURATION MAY BE DIFFERENT.
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

TITLE: PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY				
CASE 1. PROCESS FLOW DIAGRAM				
SHELL EXISTING AND PHASE 1 UPGRADERS				
CARBON DIOXIDE DEHYDRATION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
#REF!	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-008 Rev. A				

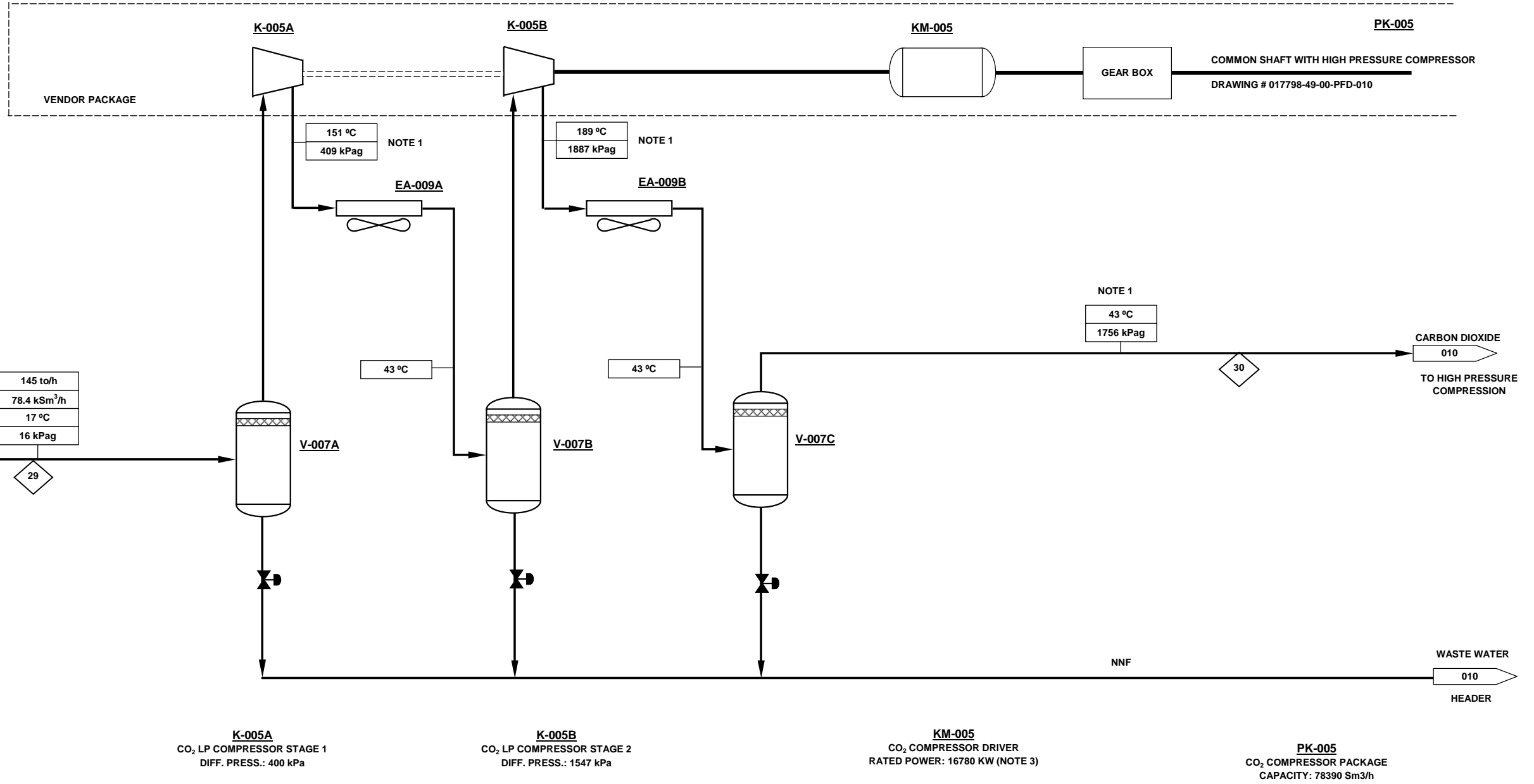
V-007A
 LP COMPRESSOR STAGE 1 INLET SEPARATOR
 DIMENSIONS: 4115 mm ID x 4115 mm T/T

V-007B
 LP COMPRESSOR STAGE 2 INLET SEPARATOR
 DIMENSIONS: 2896 mm ID x 2896 mm T/T

V-007C
 LP COMPRESSOR STAGE 2 OUTLET SEPARATOR
 DIMENSIONS: 2134 mm ID x 2309 mm T/T

EA-009A
 LP COMPRESSOR STAGE 1 AFTERCOOLER
 DUTY: 4082 KW

EA-009B
 LP COMPRESSOR STAGE 2 AFTERCOOLER
 DUTY: 5818 KW



K-005A
 CO₂ LP COMPRESSOR STAGE 1
 DIFF. PRESS.: 400 kPa

K-005B
 CO₂ LP COMPRESSOR STAGE 2
 DIFF. PRESS.: 1547 kPa

KM-005
 CO₂ COMPRESSOR DRIVER
 RATED POWER: 16780 KW (NOTE 3)

PK-005
 CO₂ COMPRESSOR PACKAGE
 CAPACITY: 78390 Sm³/h

- NOTES:
1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES
 3. RATED POWER INCLUDES ESTIMATED _ KW POWER LOSS. ACTUAL RATED POWER BY VENDOR

SNC-LAVALIN		PTAC		
TITLE: PTAC CO ₂ ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM NORTH WEST UPGRADER CARBON DIOXIDE LOW PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-009 Rev. A				

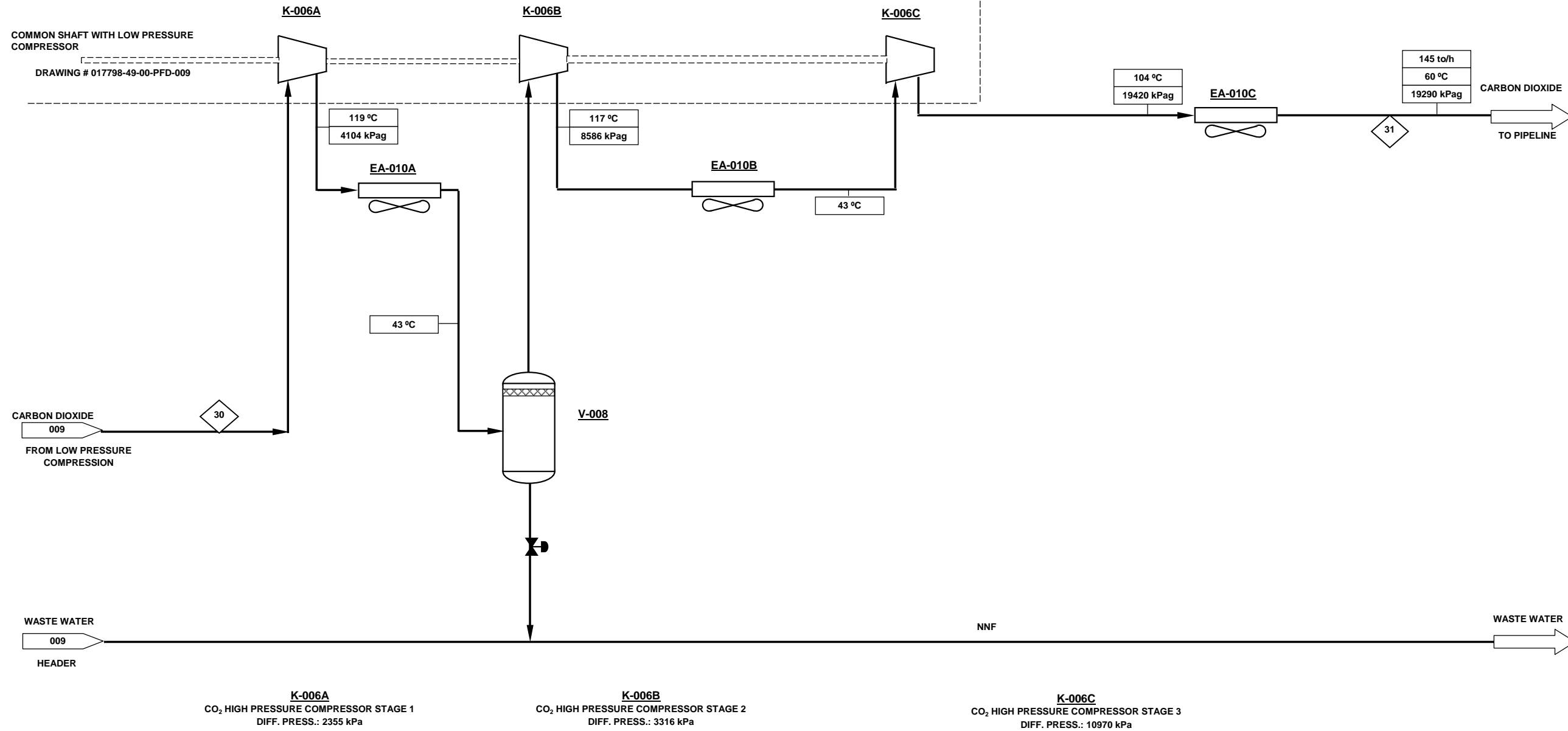
PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

V-008
 HP COMPRESSOR STAGE 1 OUTLET SEPARATOR
 DIMENSIONS: 1829 mm ID x 2182 mm T/T

EA-010A
 HP COMPRESSOR STAGE 5 AFTERCOOLER
 DUTY: 3370 KW

EA-010B
 HP COMPRESSOR STAGE 2 AFTERCOOLER
 DUTY: 5377 KW



EA-010C
 HP COMPRESSOR STAGE 3 AFTERCOOLER
 DUTY: 4410 KW



NOTES:
 1. ALL DISCHARGE PRESSURES AND TEMPERATURES ARE THEORETICAL. ACTUAL OPERATION PARAMETERS BY COMPRESSOR VENDOR
 2. ALL WEIGHT FLOWRATES REPRESENT ACTUAL ON STREAM RATES

PRELIMINARY DRAWING. DO NOT USE FOR CONSTRUCTION

SNC-LAVALIN		PTAC		
TITLE PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY CASE 1. PROCESS FLOW DIAGRAM NORTH WEST UPGRADER CARBON DIOXIDE HIGH PRESSURE COMPRESSION				
DATE	SCALE	DESIGNED BY	CHECKED BY	APPROVED
NOV 2007	NTS	SA	RW	DM
DOCUMENT NO. 017798-49-01-PFD-010 Rev. A				

		HEAT AND MATERIAL BALANCE					Client:		Rev./Date	By	Checked	Approved
		PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY					Project:		A /Dec. 2007	RT / RW	SA	DM
							Doc. #:	17798				
							Page	017798-49-01-HM-001				
							3 of 3					
Stream Number	Units	27	28	29	30	31						
Stream Description		Fuel gas to dehydration package - Shell existing and phase 1 upgraders	Flue gas to atmosphere from dehydration package - Shell existing and phase 1 upgraders	Carbon dioxide from rectisol unit	Carbon dioxide to high pressure compression - North West Upgrader	Carbon dioxide to pipeline from North West Upgrader						
Vapor Weight Fraction		1.00	1.00	1.00	1.00	0.00						
Temperature	°C	40.0	200.0	16.5	43.0	60.0						
Pressure	kPag	8.7	0.0	15.8	1756	19290						
Molar Rate	kg-mol/hr	2.63	32.8	3316	3316	3316						
Mass Rate	Ton/hr	0.046	0.915	145.2	145.2	145.168						
Actual Volumetric Flow	Am ³ /hr	62.1	1274	72113	4301	217						
Standard Volumetric Flow	Sm ³ /hr	62.2	776	78394	78394	N/A						
Enthalpy	GJ/h	-0.213	-2.23	-1299.4	-1298.3	-1323.8						
Molecular Weight		17.7	27.9	43.8	43.8	43.8						
Actual Density	kg/m ³	0.748	0.718	2.0	33.8	669.1						
Dynamic Viscosity	cP	0.012	0.023	0.014	0.016	0.049						
Thermal Conductivity	W/m-°C	0.034	0.036	0.017	0.020	0.038						
Specific Heat	kJ/kg-°C	2.157	1.151	0.873	0.987	2.705						
Surface Tension	dyne/cm	N/A	N/A	N/A	N/A	0.00						
Compressibility		0.9976	0.9997	0.9935	0.9133	0.4580						
Composition												
Carbon dioxide	% weight	4.74	13.58	99.91	99.9	99.9						
Water	% weight	0.00	10.53	0.00	0.0	0.0						
Carbon monoxide	% weight	0.00	0.00	0.03	0.03	0.03						
Methane	% weight	82.79	0.00	0.02	0.02	0.02						
Hydrogen	% weight	0.00	0.00	0.02	0.02	0.02						
Nitrogen	% weight	0.32	72.83	0.00	0.00	0.00						
Argon	% weight	0.00	0.00	0.00	0.00	0.00						
Methanol	% weight	0.00	0.00	0.01	0.01	0.01						



PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY
Case 1
Utility Balance
Electrical Power



Project No.: 017798			
Document #: 017798-49-01-UB-001			
Date	By	Checked	Approved
Dec. 2007	VC	SA	DM
Rev.:	A	Page	1 of 5

TAG NUMBER	EQUIPMENT DESCRIPTION	NORMAL		DESIGN		VOLTAGE	CONTINUOUS	INTERMITTENT	REMARKS
		POWER	Sm ³ /hr	DUTY	Sm ³ /hr				
		kW	kW	kW	kW				
P-001	LEAN AMINE PUMP - PETROCANADA		339		424		339		
EA-001	LEAN AMINE COOLER - PETROCANADA		42		52		42		
EA-002	CONDENSER - PETROCANADA		14		17		14		
EA-003 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - PETROCANADA		14		17		14		
EA-003 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - PETROCANADA		9		11		9		
EA-004 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - PETROCANADA		7		9		7		
EA-004 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - PETROCANADA		6		7		6		
EA-004 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - PETROCANADA		20		24		20		
PK-02	CO ₂ DEHYDRATION PACKAGE - PETROCANADA		11		14		11		
	SUBTOTAL PETROCANADA		460		575		460		
	CONTINGENCY			15%	86		86		
	TOTAL PETROCANADA				661		546		
P-002	LEAN AMINE PUMP - SHELL		764		955		764		
EA-005	LEAN AMINE COOLER - SHELL		28		35		28		
EA-005	LEAN AMINE COOLER - SHELL		25		31		25		
EA-006	CONDENSER - SHELL		21		26		21		
EA-007 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - SHELL		17		22		17		
EA-007 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - SHELL		13		17		13		
EA-008 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - SHELL		9		11		9		
EA-008 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - SHELL		18		22		18		
EA-008 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - SHELL		23		29		23		
PK-04	CO ₂ DEHYDRATION PACKAGE - SHELL		25		32		25		
	SUBTOTAL SHELL		944		1180		944		
	CONTINGENCY			15%	177		177		
	TOTAL SHELL				1356		1121		
EA-009 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		9		11		9		
EA-009 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		17		22		17		
EA-010 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		8		10		8		
EA-010 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		22		28		22		
EA-010 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - NORTH WEST		18		23		18		
KM-005	CO ₂ COMPRESSOR DRIVER - NORTH WEST		16780		20975		16780		
	SUBTOTAL NORTH WEST		17798		23781		19096		
	CONTINGENCY			15%	3567		3567		
	TOTAL NORTH WEST				27348		22663		
	TOTAL MAIN OPERATION AREA				25536		20500		
	CONTINGENCY			15%	3830		3830		
	TOTAL				29370		24330		

- NOTES:
1. Electrical Power for Air Coolers include a 80% efficiency factor.
 2. All the design values include a design margin (20%).
 3. Preliminary Issue. To be updated based on vendor data



PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY
Case 2
Utility Balance
Electrical Power



Project No.: 017798			
Document #: 017798-49-02-UB-001			
Date	By	Checked	Approved
Dec. 2007	RT	SA	DM
Rev.:	A	Page	1 of 5

TAG NUMBER	EQUIPMENT DESCRIPTION	NORMAL		DESIGN		VOLTAGE	CONTINUOUS	INTERMITTENT	REMARKS
		POWER	Sm ³ /hr	DUTY	Sm ³ /hr				
		kW	kW	kW	kW				
P-001	LEAN AMINE PUMP - PETROCANADA		339		424		339		
EA-001	LEAN AMINE COOLER - PETROCANADA		42		52		42		
EA-002	CONDENSER - PETROCANADA		14		17		14		
EA-003 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - PETROCANADA		14		17		14		
EA-003 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - PETROCANADA		9		11		9		
	SUBTOTAL PETROCANADA		416		521		416		
	CONTINGENCY			15%	78		78		
	TOTAL PETROCANADA				599		495		
P-002	LEAN AMINE PUMP - SHELL		764		955		764		
EA-005	LEAN AMINE COOLER - SHELL		28		35		28		
EA-005	LEAN AMINE COOLER - SHELL		25		31		25		
EA-006	CONDENSER - SHELL		21		26		21		
EA-007 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - SHELL		17		22		17		
EA-007 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - SHELL		13		17		13		
	SUBTOTAL SHELL		868		1085		868		
	CONTINGENCY			15%	163		163		
	TOTAL SHELL				1248		1031		
EA-008 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - COMMON DEL. PT.		19		23		19		
EA-008 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - COMMON DEL. PT.		21		26		21		
EA-008 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - COMMON DEL. PT.		75		94		75		
PK-04	CO ₂ DEHYDRATION PACKAGE - COMMON DELIVERY POINT		43		53		43		
	CO ₂ COMPRESSOR DRIVER - COMMON DELIVERY POINT		15200		19000		15200		
	SUBTOTAL COMMON DELIVERY POINT		15357		19196		15357		
	CONTINGENCY			15%	2879		2879		
	TOTAL COMMON DELIVERY POINT				22076		18236		
EA-009 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		9		11		9		
EA-009 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		17		22		17		
EA-010 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		8		10		8		
EA-010 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		22		28		22		
EA-010 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - NORTH WEST		18		23		18		
KM-005	CO ₂ COMPRESSOR DRIVER - NORTH WEST		16800		21000		16800		
	SUBTOTAL NORTH WEST		16875		21093		16875		
	CONTINGENCY			15%	3164		3164		
	TOTAL NORTH WEST				24257		20039		
	TOTAL MAIN OPERATION AREA				41895		33516		
	CONTINGENCY			15%	6284		6284		
	TOTAL				48184		39801		

- NOTES:
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 3. Preliminary Issue. To be updated based on vendor data



PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY
Case 3
Utility Balance
Electrical Power



Project No.: 017798			
Document #: 017798-49-03-UB-001			
Date	By	Checked	Approved
Dec. 2007	RT	SA	DM
Rev.:	A	Page	1 of 5

TAG NUMBER	EQUIPMENT DESCRIPTION	NORMAL		DESIGN		VOLTAGE	CONTINUOUS	INTERMITTENT	REMARKS
		POWER	Sm ³ /hr	DUTY	Sm ³ /hr				
		kW	kW	kW	kW				
P-001	LEAN AMINE PUMP - PETROCANADA		339		424			339	
EA-001	LEAN AMINE COOLER - PETROCANADA		42		52			42	
EA-002	CONDENSER - PETROCANADA		14		17			14	
EA-003 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - PETROCANADA		14		17			14	
EA-003 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - PETROCANADA		9		11			9	
EA-004 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - PETROCANADA		10		12			10	
EA-004 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - PETROCANADA		7		9			7	
PK-02	CO ₂ DEHYDRATION PACKAGE - PETROCANADA		11		14			11	
	SUBTOTAL PETROCANADA		445		556			445	
	CONTINGENCY			15%	83			83	
	TOTAL PETROCANADA				639			528	
P-002	LEAN AMINE PUMP - SHELL		764		955			764	
EA-005	LEAN AMINE COOLER - SHELL		28		35			28	
EA-005	LEAN AMINE COOLER - SHELL		25		31			25	
EA-006	CONDENSER - SHELL		21		26			21	
EA-007 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - SHELL		17		22			17	
EA-007 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - SHELL		13		17			13	
EA-008 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - SHELL		13		16			13	
EA-008 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - SHELL		22		28			22	
PK-04	CO ₂ DEHYDRATION PACKAGE - SHELL		25		32			25	
	SUBTOTAL SHELL		928		1160			928	
	CONTINGENCY			15%	174			174	
	TOTAL SHELL				1334			1102	
EA-009 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		9		11			9	
EA-009 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		17		22			17	
EA-010 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		11		13			11	
EA-010 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		30		37			30	
KM-005	CO ₂ COMPRESSOR DRIVER - NORTH WEST		16800		21000			16800	
	SUBTOTAL NORTH WEST		16867		21083			16867	
	CONTINGENCY			15%	3162			3162	
	TOTAL NORTH WEST				24246			20029	
	CO ₂ INJECTION PUMP		1443		1804			1443	
	CONTINGENCY			15%	271			271	
	TOTAL COMMON DELIVERY POINT				2074			1714	
	TOTAL MAIN OPERATION AREA				24603			19683	
	CONTINGENCY			15%	3690			3690	
	TOTAL				28298			23373	

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PTAC CO2 ENHANCED HYDROCARBON RECOVERY STUDY
Case 4
Utility Balance
Electrical Power



Project No.: 017798			
Document #: 017798-49-04-UB-001			
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TAG NUMBER	EQUIPMENT DESCRIPTION	NORMAL		DESIGN		VOLTAGE	CONTINUOUS	INTERMITTENT	REMARKS
		POWER	Sm ³ /hr	DUTY	Sm ³ /hr				
		kW	kW	kW	kW				
P-001	LEAN AMINE PUMP - PETROCANADA		809		1011		809		
EA-001	LEAN AMINE COOLER - PETROCANADA		42		52		42		
	RICH AMINE PUMP - PETROCANADA		47		59		47		
	SUBTOTAL PETROCANADA		897		1122		897		
	CONTINGENCY			15%	168		168		
	TOTAL PETROCANADA				1290		1066		
P-002	LEAN AMINE PUMP - SHELL		2211		2764		2211		
EA-005	LEAN AMINE COOLER - SHELL		28		35		28		
EA-005	LEAN AMINE COOLER - SHELL		25		31		25		
	RICH AMINE PUMP - SHELL		836		1046		836		
	SUBTOTAL SHELL		3100		3875		3100		
	CONTINGENCY			15%	581		581		
	TOTAL SHELL				4456		3681		
EA-009 A	LP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		9		11		9		
EA-009 B	LP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		17		22		17		
EA-010 A	HP COMPRESSOR 1ST STAGE AFTERCOOLER - NORTH WEST		8		10		8		
EA-010 B	HP COMPRESSOR 2ND STAGE AFTERCOOLER - NORTH WEST		22		28		22		
EA-010 C	HP COMPRESSOR 3RD STAGE AFTERCOOLER - NORTH WEST		18		23		18		
KM-005	CO ₂ COMPRESSOR DRIVER - NORTH WEST		16780		20975		16780		
	SUBTOTAL NORTH WEST		16855		21068		16855		
	CONTINGENCY			15%	3160		3160		
	TOTAL NORTH WEST				24229		20015		
	LP COMPRESSOR 1ST STAGE AFTERCOOLER - COMMON DEL. PT.		27		34		27		
	LP COMPRESSOR 2ND STAGE AFTERCOOLER - COMMON DEL. PT.		19		24		19		
	HP COMPRESSOR 1ST STAGE AFTERCOOLER - COMMON DEL. PT.		14		18		14		
	HP COMPRESSOR 2ND STAGE AFTERCOOLER - COMMON DEL. PT.		17		21		17		
	HP COMPRESSOR 3RD STAGE AFTERCOOLER - COMMON DEL. PT.		41		51		41		
	CONDENSER - COMMON DELIVERY POINT		28		35		28		
	CO ₂ DEHYDRATION PACKAGE - COMMON DELIVERY POINT		88		110		88		
	SUBTOTAL NORTH COMMON DELIVERY POINT		234		292		234		
	CONTINGENCY			15%	44		44		
	TOTAL NORTH COMMON DELIVERY POINT				336		278		
	TOTAL MAIN OPERATION AREA				26358		21086		
	CONTINGENCY			15%	3954		3954		
	TOTAL				30315		25040		

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