

Nitrogen Rejection Unit #493



Contact
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1. Executive Summary

1.1 Plant History

Built 1983
Shut down 2009

1.2 Production Capacity

45 MMSCFD per train X 2 trains
Each train has wide turndown capacity to accommodate a loss of flow from the production wells at any time.

1.3 Plant Function

The NRU is designed to produce the follow products from natural gas containing 80% nitrogen:

- Ethane-rich gas, suitable for de-methanation.
- Methane-rich gas, to be used as fuel or sales gas.
- A waste nitrogen stream, vented to atmosphere or used for rejection.

2. Process Description

The NRU uses methane (C1) as a refrigerant. There are 5 streams in the process: 1) Low pressure C1; 2) High pressure C1; 3) C2+ stream; 4) Feed gas; 5) Vent stream.

The pretreated natural gas enters the NRU's warm feed exchangers where initial cool down starts. From there it passes through the warm feed separator to know out some initial liquids. They are dumped into the C2+ stream going to the cold feed exchangers. Leaving here the gas heads to a CO2 column. In this scrubber column, about 96% of the N2 is removed and sent to the back end (double column box). A small amount of C1 also is sent to the D/C box. CO2 is scrubbed out of this overhead stream and sent out with the C2+ stream, this would freeze in the extream temperatures of the double column box (-290). The C2+ stream simply put is the CO2 column bottoms liquids. This C2+ stream heads out of the train exchanging temperatures with feed gas coming in. This helps to start vaporizing these liquids that are on the way to a compressor and helping to cool the inlet gas.

The N2 and C1 that goes out the top of the CO2 column heads through the D/C feed exchanger (can be bypassed around this). Next it heads to the bottom of the high pressure column where further chilling and separation takes place. From here some of the gas goes through the D/C reboiler condenser and the D/C reflux condenser. The rest of the stream goes over to the CO2 column subcooler to cool incoming refrigerant, then heads to the inlet of the NRU expanders. Here the pressure drops from about 250 # to 30 #. This action creates a lot of refrigeration by taking all of that energy out of the gas stream. This 30 # gas stream then goes through the LP

feed separator and to the LP column. This is where final separation takes place. The separated N2 goes out the top and the liquefied natural gas (LNG) goes out the bottom headed for the refrigerant Lotema suction.

The N2 heads out of the box towards the vent stack, but on its way out it provides a lot of cooling in exchangers. When there is enough vent flow established, the reinject Lotema are started. These pull suction off the vent stream and pump up the 30 # vent to about 500 # and send it to the suction of the reinject compressors.

The LP C1 (LNG) heads out of the bottom of the LP column going out of the train; this also provides a lot of refrigeration on its way out. There are LNG pumps to send this LNG out of the train, but they are currently not used. The LNG is pressure pushed out of the trains using vent backpressure. This stream vaporizes on the way to Lotema and is pumped up to 550 # and sent back to the train. Passing through the warm feed exchanger, cold feed exchangers, and to the top of the CO2 column, here after passes through the CO2 subcooler. This takes it back down from 550 # to whatever the LP C1 circuit is running. This is where it ties back in with C1 suction (this is a closed loop) headed back out of the train.

The Lotema compressors are 4-stage compressors, and 3rd stage pumps up more than 4th stage can handle. So the operation has two options: flare off the excess 3rd stage or send it to the compressor suction using PC 498 (generally it only flares when the LNG is off-spec). These Lotema compressors also have dry compressor cylinders, so lube oil cannot work its way into the train; such as with the compressors which tend to lose quite a bit of oil in the compressor cylinders. The compressor setup is really quite versatile. There are 4 Lotema compressors. Two of these are solely dedicated to refrigerant service, while the other two can run in either refrigerant or reinjection service.

There are 4 Joy compressors. All four have been piped up to run in gas plant service or reinject service. Compressor A & B will run in either service, but C & D has been turned down. The plant cannot pump up gas to the 2000 # header pressure that reinject service requires.

3. Highlights of Major Equipment

3.1 Warm Exchanger Skids (Train 1 and 2)

Four (4) Warm Feed Exchangers: Equipment # 05.20A, B for Train 1; 05.20 C, D for Train 2

Manufacturer: Stewart Warner Corp

Type: Brazed Core Extended Surface Countercurrent

Weight (empty): 18,100 Lbs per exchanger

Design temperature, °F: - 320 to 150

Design pressure: 640 psig

Warm Feed Separator (Equipment # 07.80)

Manufacturer: Air Products & Chemicals

Dimension: 54" ID X 10'-9" S-S
Weight: 12,050 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 40
Design pressure, psig: 640
Operating pressure, psig: 505

Warm JPG Feed Distributor (Equipment # 07.90)

Manufacturer: Air Products & Chemicals
Dimension: 36" ID X 7'-9" S-S
Weight (empty): 4,900 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 52
Design pressure, psig: 640
Operating pressure, psig: 280

3.2 Cold Feed Exchanger Box

Cold Feed Exchanger Box (Equipment # 11.30)

Manufacturer: Air Products & Chemicals
Dimension: 37' H X 12'-2" W X 12'-6" D
Weight (estimated with insulation): 175,000 Lbs

Cold Feed Exchangers (Equipment # 05.22 A & B)

Manufacturer: Stewart Warner Corp
Type: Brazed Core Extended Surface Countercurrent
Weight (empty): 19,600 Lbs per exchanger
Design temperature, °F: - 320 to 150
Design pressure: 640 psig

Cold JPG Feed Distributor (Equipment # 07.92)

Manufacturer: Air Products & Chemicals
Dimension: 30" ID X 8' H
Weight (empty): 2,580 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 146
Design pressure, psig: 640
Operating pressure, psig: 280

Warm Refrigerant Distributor (Equipment # 07.95)

Manufacturer: Air Products & Chemicals
Dimension: 42" ID X 9' S-S
Weight (empty): 6,100 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 236

Design pressure, psig: 640
Operating pressure, psig: 213

3.3 CO2 Column Box

CO2 Column Box (Equipment # 11.10)

Manufacturer: Air Products & Chemicals
Dimension: 112' H X 12' W X 12'-6" D
Weight (estimated, with insulation): 480,000 Lbs

Cold Column Condenser (Equipment # 05.27)

Manufacturer: Stewart Warner Corp.
Type: Brazed Core Extended Surface
Weight (empty): 9,225 Lbs (Train 1); 9,250 Lbs (Train 2)
Design temperature, °F: - 320 to 150
Design pressure, psig: 640

CO2 Column Reboiler (05.28)

Manufacturer: Stewart Warner Corp.
Type: Brazed Core Extended Surface
Weight (empty): 7,075 Lbs
Design temperature, °F: - 320 to 150
Design pressure, psig: 640

CO2 Column Subcooler (05.29)

Manufacturer: Stewart Warner Corp.
Type: Brazed Core Extended Surface
Weight (empty): 3,320Lbs
Design temperature, °F: - 320 to 150
Design pressure, psig: 640

CO2 Column (07.01)

Manufacturer: Air Products & Chemicals
Dimension: 6' ID (top) 3' ID (bottom) X 76'-6" S-S
Weight (empty): 95,000 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 144 to -232
Design pressure, psig: 640
Operating pressure, psig: 388 to 505

C2 Column Feed Separator (Equipment # 07.81)

Manufacturer: Air Products & Chemicals
Dimension: 48" ID X 8'-9" S-S
Weight (empty): 7,035 Lbs

Design temperature, °F: - 320 to 150
Operating temperature: °F: - 100
Design pressure, psig: 640
Operating pressure, psig: 502

Cold Feed Separator (Equipment # 07.82)

Manufacturer: Air Products & Chemicals
Dimension: 48" ID X 8'-9" S-S
Weight (empty): 7,035 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 100
Design pressure, psig: 640
Operating pressure, psig: 502

CO2 Column Reflux Accumulator (Equipment # 07.83)

Manufacturer: Air Products & Chemicals
Dimension: 48" ID X 13'-9" S-S
Weight (empty): 9,530 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 232
Design pressure, psig: 640
Operating pressure, psig: 384 to 500

CO2 Column Reboiler Separator (Equipment # 07.84)

Manufacturer: Air Products & Chemicals
Dimension: 48" ID X 8'-9" S-S
Weight (empty): 6,735 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 115
Design pressure, psig: 640
Operating pressure, psig: 498

Cold Refrigerant Distributor (Equipment # 07.93)

Manufacturer: Air Products & Chemicals
Dimension: 36" ID X 7'-9" S-S
Weight (empty): 4,100 Lbs
Design temperature, °F: - 320 to 150
Operating temperature: °F: - 240
Design pressure, psig: 640
Operating pressure, psig: 215

3.4 Double Column Cold Box

Double Column Cold Box (Equipment # 11.20)

Manufacturer: Air Products & Chemicals
Dimension: 112'-6" H X 12' W X 12'-6" D
Weight (estimated, with insulation): 280,000 Lbs

Double Column Feed Exchanger (Equipment # 05.23)

Manufacturer: Stewart Warner Corp
Type: Brazed Core Extended Surface
Weight (empty): 17,300 Lbs per exchanger
Design temperature, °F: - 320 to 150
Design pressure: 640 psig

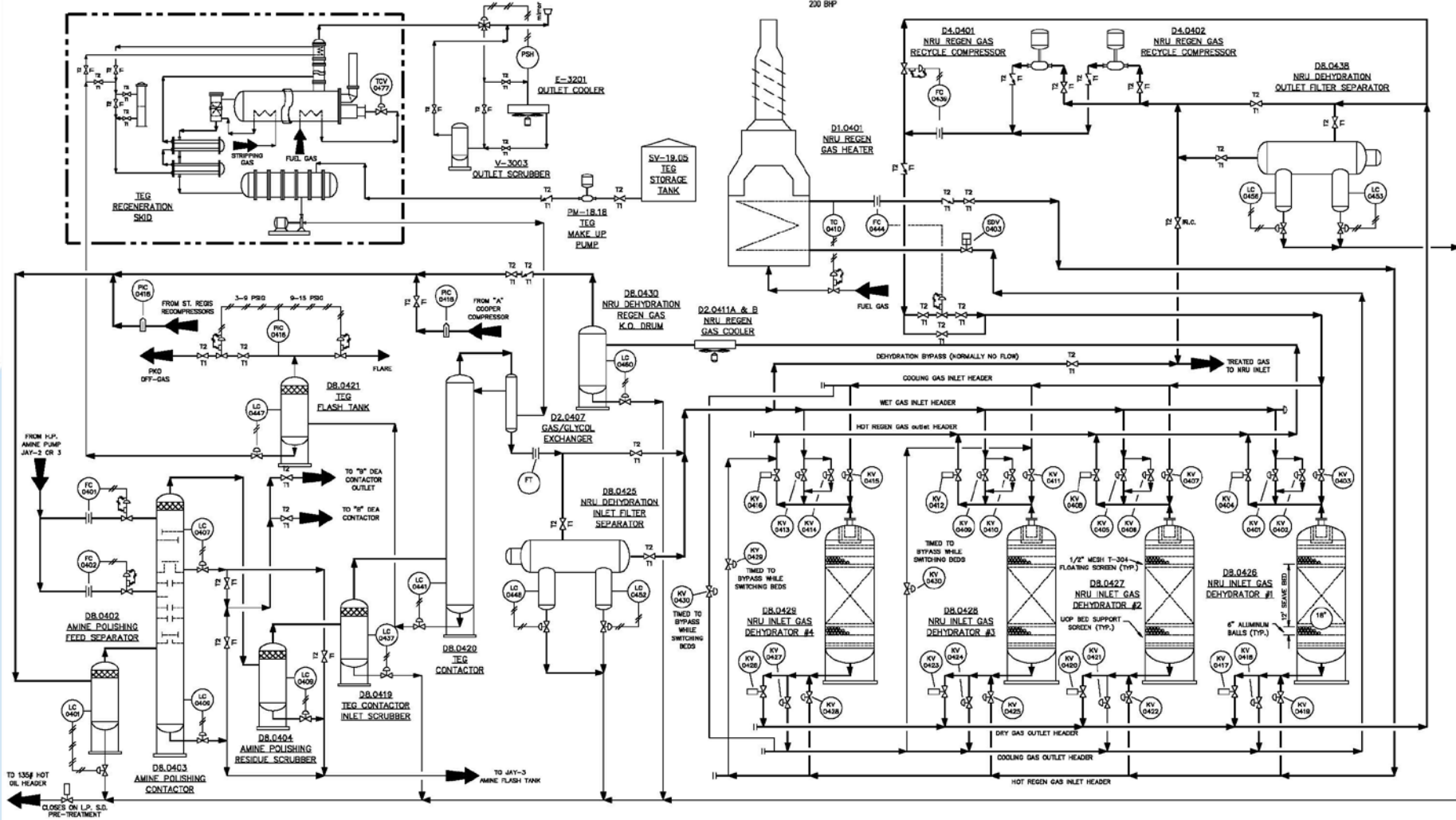
Reflux Subcooler (Equipment # 05.25)

Manufacturer: Stewart Warner Corp
Type: Brazed Core Extended Surface
Weight (empty): 3,225 Lbs (Train 1), 3,425 Lbs (Train 2)
Design temperature, °F: - 320 to 150
Design pressure, psig: 640

Double Column Reboiler / Condenser (Equipment # 05.26)

Manufacturer: Stewart Warner Corp
Type: Brazed Core Extended Surface countercurrent
Weight (empty): 5,150 Lbs (Train 1), 5,250 Lbs (Train 2)
Design temperature, °F: - 320 to 150
Design pressure: 640 psig

TEG REGENERATION SKID	D8.0421 TEG FLASH TANK	D2.0407 GAS/GLYCOL EXCHANGER	V-3003 OUTLET SCRUBBER	E-3201 OUTLET COOLER	PM-18.18 TEG MAKE-UP PUMP	SV-19.05 TEG STORAGE TANK	D8.0430 NRU DEHYDRATION REGEN GAS K.O. DRUM	D2.0411A & B NRU REGEN GAS COOLER	D4.0401 & 02 NRU REGEN GAS RECYCLE COMPRESSOR	D8.0429 NRU INLET GAS DEHYDRATOR #4	D1.0401 NRU REGEN GAS HEATER	D8.0428 NRU INLET GAS DEHYDRATOR #3	D8.0427 NRU INLET GAS DEHYDRATOR #2	D8.0426 NRU INLET GAS DEHYDRATOR #1	D8.0438 NRU DEHYDRATION OUTLET FILTER SEPARATOR
	54" I.D. x 11'-0" S/S XXX BELLS	OPER: XXX PSIG/XXXT DES: 140 PSIG/250T	OPER: XXX PSIG/XXXT DES: 325 PSIG/380T	OPER: XXX PSIG/XXXT DES: XXX PSIG/XXXT	OPER: XXX PSIG/XXXT DES: XXX PSIG/XXXT	10' O.D. x 12'-0" HIGH 150 BELLS	30" I.D. x 10'-0" S/S OPER: XXX PSIG/XXXT DES: 675 PSIG/200T	OPER: XXX PSIG/XXXT DES: XXX PSIG/XXXT	OPER: XXX MSF/D DES: 200 MSF/D SUCT. PRESS: 325 PSIG DISCH. PRESS: 605 PSIG 200 BHP	78" I.D. x 17'-0" S/S OPER: XXX PSIG/XXXT DES: 685 PSIG/630T	OPER: XXX PSIG/XXXT DES: 14,843 MBTU/HR	78" I.D. x 17'-0" S/S OPER: XXX PSIG/XXXT DES: 685 PSIG/630T	78" I.D. x 17'-0" S/S OPER: XXX PSIG/XXXT DES: 685 PSIG/630T	78" I.D. x 17'-0" S/S OPER: XXX PSIG/XXXT DES: 685 PSIG/630T	36" O.D. x 10'-0" S/S OPER: 540 PSIG/XXXT DES: 640 PSIG/170T

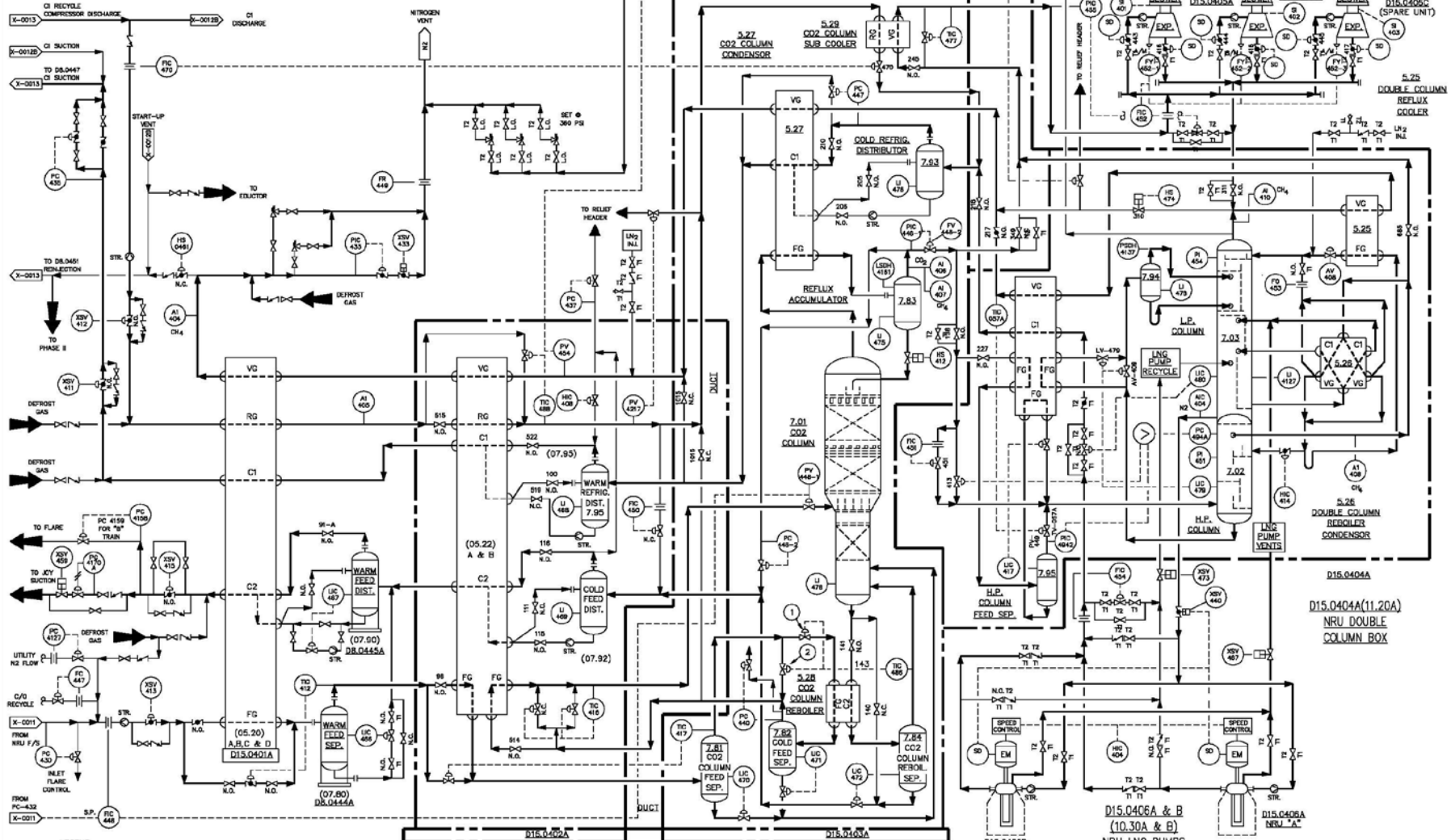


D8.0402 AMINE POLISHING FEED SEPARATOR	D8.0404 AMINE POLISHING OUTLET SCRUBBER	D8.0403 AMINE POLISHING CONTACTOR	D8.0420 TEG CONTACTOR	D8.0419 TEG CONTACTOR INLET SCRUBBER	D8.0425 NRU DEHYDRATION INLET FILTER SEPARATOR
84" I.D. x 12'-0" S/S OPER: XXX PSIG/XXXT DES: 647 PSIG/340T	72" I.D. x 10'-0" S/S OPER: XXX PSIG/XXXT DES: 652 PSIG/312T	90" I.D. x 10'-0" S/S 41 TRAYS OPER: XXX PSIG/XXXT DES: 652 PSIG/200T	84" I.D. x 30'-8" S/S 10 VALVE TRAYS OPER: XXX PSIG/XXXT DES: 660 PSIG/200T	72" I.D. x 10'-0" S/S OPER: XXX PSIG/XXXT DES: 652 PSIG/200T	36" I.D. x 9'-0" S/S OPER: XXX PSIG/XXXT DES: 640 PSIG/170T

D15.0401A (5.20A, B, C & D) D8.0444A (07.80) D15.0402A (11.30A) D8.0445A (07.90) D15.0403A(11.10A)
 NRU WARM FEED EXCHANGER SKID NRU WARM FEED SEPARATOR NRU COLD FEED EXCHANGER BOX NRU WARM JGP FEED SEPARATOR NRU CO2 COLUMN BOX

54" I.D. x 10'-9" S-S
 MAMP: 640 PSIG @ 150' / -320T

36" I.D. x 7'-9" S-S
 MAMP: 640 PSIG @ 150' / -320T



LEGEND
 VG - VENT GAS
 NG - METHANE REFRIGERANT
 C1 - METHANE FROM COLD BORES
 C2 - TO JAY GAS PLANT
 (NOTE: THE LARGEST COMPONENT OF THE C2 PLUS STREAM IS METHANE.)
 FC - FEED GAS

TIC 495 INFORMATION

INLET	OR OUTPUT	50% OUTPUT	100% OUTPUT
No. 1 VALVE	100% OPEN	100% OPEN	CLOSED
No. 2 VALVE	CLOSED	100% OPEN	100% OPEN

