envirotech
Analytical Laboratory

Analysis Certificate

Analysis Requested: **GPA 2286_14**

Client:	Red Cedar Gathering	Project #:	95031-0055
Site Name:	South Ignacio	Compensations:	Air & Helium Free
Laboratory ID:	P903003-01	Date Reported:	03-21-19
Sampled by:	K Hunderman	Date Sampled:	02-26-19
Analyzed by:	Irene Yazzie	Date Received:	03-01-19
Sample Pressure:	395.7 psig	Date Analyzed:	03-15-19
Sample Temperature:	86.8 F	Analysis Time:	Std

GPA 2286_14 report

Components	Mol %	Wt %	L.V. %
Helium	BRL	BRL	BRL
Oxygen	BRL	BRL	BRL
Nitrogen	BRL	BRL	BRL
Carbon Dioxide	5.9368	14.7106	5.9590
Methane	93.6937	84.6267	93.4510
Ethane	0.3392	0.5743	0.5310
Propane	0.0215	0.0535	0.0590
Iso-Butane	0.0034	0.0113	BRL
N-Butane	0.0027	0.0090	BRL
Iso-Pentane	BRL	BRL	BRL
N-Pentane	BRL	BRL	BRL
iso-Hexanes	0.0013	0.0064	BRL
Benzene	0.0001	0.0005	BRL
n-Hexane	BRL	BRL	BRL
iso-Heptanes	0.0011	0.0064	BRL
Toluene	BRL	BRL	BRL
n-Heptane	BRL	BRL	BRL
iso-Octanes	0.0002	0.0013	BRL
n-Octane	BRL	BRL	BRL
n-Nonane	BRL	BRL	BRL
iso-Decanes	BRL	BRL	BRL
n-Decane	BRL	BRL	BRL
Totals	**100.0000**	**100.0000**	**100.0000**

BRL = Value below the method reportable limit = 0.0001% **N/R = Parameter not recorded**

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Analytical Laboratory

Analysis Certificate

Analysis Requested: **GPA 2286_14**

Client:	Red Cedar Gathering	Project #:	95031-0055
Site Name:	South Ignacio	Compensations:	Air & Helium Free
Laboratory ID:	P903003-01	Date Reported:	03-21-19
Sampled by:	K Hunderman	Date Sampled:	02-26-19
Analyzed by:	Irene Yazzie	Date Received:	03-01-19
Sample Pressure:	395.7 psig	Date Analyzed:	03-15-19
Sample Temperature:	86.8 F	Analysis Time:	Std

GPA 2261_13 Report

Components	Mol %	Wt %	L.V. %
Carbon Dioxide	5.9368	14.7106	5.9590
Hydrogen Sulfide	BRL	BRL	BRL
Nitrogen	BRL	BRL	BRL
Methane	93.6937	84.6267	93.4510
Ethane	0.3392	0.5743	0.5310
Propane	0.0215	0.0535	0.0590
Iso-Butane	0.0034	0.0113	BRL
N-Butane	0.0027	0.0090	BRL
Iso-Pentane	BRL	BRL	BRL
N-Pentane	BRL	BRL	BRL
C6+	0.0027	0.0146	BRL
Helium	BRL	BRL	BRL
Oxygen	BRL	BRL	BRL
Totals	**100.0000**	**100.0000**	**100.0000**

BRL = Value below the method reportable limit = 0.0001% **N/R = Parameter not recorded**

Group Reports

Components	Mol %	Wt %	L.V. %
Hexanes	0.0014	0.0069	BRL
Heptanes	0.0011	0.0064	BRL
Octanes	0.0002	0.0013	BRL
Nonanes	BRL	BRL	BRL
Heaviers	BRL	BRL	BRL
Totals	**0.0027**	**0.0146**	**0.0000**

C6+	0.0027	0.0146	BRL
C7+	0.0013	0.0077	BRL
C8+	0.0002	0.0013	BRL
C9+	BRL	BRL	BRL

BRL = Value below the method reportable limit = 0.0001% **N/R = Parameter not recorded**

envirotech
Analytical Laboratory

Analysis Certificate

Analysis Requested: **GPA 2286_14**

Client:	Red Cedar Gathering	Project #:	95031-0055
Site Name:	South Ignacio	Compensations:	Air & Helium Free
Laboratory ID:	P903003-01	Date Reported:	03-21-19
Sampled by:	K Hunderman	Date Sampled:	02-26-19
Analyzed by:	Irene Yazzie	Date Received:	03-01-19
Sample Pressure:	395.7 psig	Date Analyzed:	03-15-19
Sample Temperature:	86.8 F	Analysis Time:	Std

Glycal Report

Components	Mol %	Wt %	L.V. %
Carbon Dioxide	5.9368	14.7106	5.9590
Hydrogen Sulfide	BRL	BRL	BRL
Nitrogen	BRL	BRL	BRL
Methane	93.6937	84.6267	93.4510
Ethane	0.3392	0.5743	0.5310
Propane	0.0215	0.0535	0.0590
Iso-Butane	0.0034	0.0113	BRL
N-Butane	0.0027	0.0090	BRL
Iso-Pentane	BRL	BRL	BRL
N-Pentane	BRL	BRL	BRL
Cyclopentane	BRL	BRL	BRL
n-Hexane	BRL	BRL	BRL
Cyclohexane	BRL	BRL	BRL
Other Hexanes	0.0013	0.0064	BRL
n-Heptane	BRL	BRL	BRL
Methylcyclohexane	0.0001	0.0006	BRL
2,2,4 Trimethylpentane	BRL	BRL	BRL
Benzene	0.0001	0.0005	BRL
Toluene	BRL	BRL	BRL
EthylBenzene	BRL	BRL	BRL
Xylenes	BRL	BRL	BRL
Heaviers	BRL	BRL	BRL

BRL = Value below the method reportable limit = 0.0001% **N/R = Parameter not recorded**

envirotech
Analytical Laboratory

Analysis Certificate

Analysis Requested: **GPA 2286_14**

Client:	Red Cedar Gathering	Project #:	95031-0055
Site Name:	South Ignacio	Compensations:	Air & Helium Free
Laboratory ID:	P903003-01	Date Reported:	03-21-19
Sampled by:	K Hunderman	Date Sampled:	02-26-19
Analyzed by:	Irene Yazzie	Date Received:	03-01-19
Sample Pressure:	395.7 psig	Date Analyzed:	03-15-19
Sample Temperature:	86.8 F	Analysis Time:	Std

GPA 2172_09 Report Calculations @ 14.696 psia and 60 degrees F

Compressibility Factor Dry Gas	0.9978	Compressibility Factor Sat Gas	0.9975
GPM C2+	0.099	GPM C3+	0.009
GPM C4+	0.003	GPM C5+	0.001
Ideal Dry Gas Relative Density:	0.613	Ideal Sat Gas Relative Density:	0.603
Real Dry Gas Relative Density:	0.614	Real Sat Gas Relative Density:	0.604
Dry Molecular Weight:	17.761	Sat Molecular Weight:	17.451
Gross HV per Ideal Dry ft3:	953.19	Gross HV per Ideal Sat ft3:	936.56
Gross HV per Real Dry ft3:	955.29	Gross HV per Real Sat ft3:	938.91

C6+ Calculations

Ideal C6+ Dry Relative Density	3.288	C6+ Dry Molecular Weight	95.218
C6+ Compressibility Factor	0.883	C6+ Gross HV per Ideal Dry ft3	5215.5

BRL = Value below the method reportable limit = 0.0001% **N/R = Parameter not recorded**

Irene Yazzie — 3/21/2019

Analyst — Date

Irene Yazzie

Printed

Comments: 03-21-19 revised per Khunderman.

Note: The above analyses are performed in compliance with GPA 2286_14 quality assurance procedures.

References: GPA 2286_14, TP-17, GPA Standard 2145-09 and GPA Standard 2172-09

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: South Ignacio - D1 PTE - Feb '19
File Name: \\durnetapp101\Shared\Durango Shared\EHS\Air Permits\GLYCalc files\South Ignacio\SOU D1 2019 02 PTE (uncontrolled).ddf
Date: March 27, 2019

DESCRIPTION:

Description: 30 MMscfd dehy unit; Feb '19 gas analysis, max design gas flow, temp, and pressure; max glycol rate (1 Kimray 50015)

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.5159	12.382	2.2596
Ethane	0.0390	0.935	0.1707
Propane	0.0116	0.279	0.0509
Isobutane	0.0046	0.110	0.0200
n-Butane	0.0055	0.132	0.0241
Other Hexanes	0.0089	0.213	0.0388
Methylcyclohexane	0.0066	0.159	0.0289
Benzene	0.0348	0.835	0.1523
Total Emissions	0.6268	15.044	2.7455
Total Hydrocarbon Emissions	0.6268	15.044	2.7455
Total VOC Emissions	0.0719	1.727	0.3151
Total HAP Emissions	0.0348	0.835	0.1523
Total BTEX Emissions	0.0348	0.835	0.1523

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.5157	12.377	2.2589
Ethane	0.0100	0.241	0.0440
Propane	0.0013	0.030	0.0055
Isobutane	0.0003	0.007	0.0013
n-Butane	0.0003	0.006	0.0012
Other Hexanes	0.0002	0.005	0.0008
Methylcyclohexane	<0.0001	<0.001	0.0001
Benzene	<0.0001	<0.001	0.0001
Total Emissions	0.5278	12.668	2.3119
Total Hydrocarbon Emissions	0.5278	12.668	2.3119
Total VOC Emissions	0.0021	0.049	0.0090
Total HAP Emissions	<0.0001	<0.001	0.0001
Total BTEX Emissions	<0.0001	<0.001	0.0001

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	10.3146	247.549	45.1778
Ethane	0.2010	4.823	0.8802
Propane	0.0251	0.603	0.1100
Isobutane	0.0060	0.145	0.0265
n-Butane	0.0054	0.129	0.0235
Other Hexanes	0.0038	0.092	0.0169
Methylcyclohexane	0.0004	0.009	0.0017
Benzene	0.0003	0.008	0.0014
Total Emissions	10.5566	253.359	46.2379
Total Hydrocarbon Emissions	10.5566	253.359	46.2379
Total VOC Emissions	0.0411	0.986	0.1800
Total HAP Emissions	0.0003	0.008	0.0014
Total BTEX Emissions	0.0003	0.008	0.0014

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.0316	24.759	4.5185
Ethane	0.0490	1.177	0.2147
Propane	0.0129	0.309	0.0564
Isobutane	0.0049	0.117	0.0213
n-Butane	0.0058	0.139	0.0253
Other Hexanes	0.0091	0.217	0.0397
Methylcyclohexane	0.0066	0.159	0.0290
Benzene	0.0348	0.835	0.1524
Total Emissions	1.1546	27.712	5.0574
Total Hydrocarbon Emissions	1.1546	27.712	5.0574
Total VOC Emissions	0.0740	1.776	0.3241
Total HAP Emissions	0.0348	0.835	0.1524
Total BTEX Emissions	0.0348	0.835	0.1524

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	47.4374	4.5185	90.47
Ethane	1.0509	0.2147	79.57
Propane	0.1609	0.0564	64.93
Isobutane	0.0465	0.0213	54.12
n-Butane	0.0476	0.0253	46.94
Other Hexanes	0.0557	0.0397	28.76
Methylcyclohexane	0.0306	0.0290	5.27
Benzene	0.1538	0.1524	0.89
Total Emissions	48.9834	5.0574	89.68
Total Hydrocarbon Emissions	48.9834	5.0574	89.68
Total VOC Emissions	0.4951	0.3241	34.54
Total HAP Emissions	0.1538	0.1524	0.89
Total BTEX Emissions	0.1538	0.1524	0.89

EQUIPMENT REPORTS:

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	6.52 lbs. H2O/MMSCF
Temperature:	120.0 deg. F
Pressure:	720.0 psig
Dry Gas Flow Rate:	30.0000 MMSCF/day
Glycol Losses with Dry Gas:	0.6375 lb/hr
Wet Gas Water Content:	Saturated
Calculated Wet Gas Water Content:	131.06 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	3.20 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	4.96%	95.04%
Carbon Dioxide	99.74%	0.26%
Methane	99.98%	0.02%
Ethane	99.93%	0.07%
Propane	99.88%	0.12%
Isobutane	99.84%	0.16%
n-Butane	99.79%	0.21%
Other Hexanes	99.66%	0.34%
Methylcyclohexane	97.84%	2.16%
Benzene	86.36%	13.64%

FLASH TANK

Flash Control:	Combustion device
Flash Control Efficiency:	95.00 %
Flash Temperature:	100.0 deg. F
Flash Pressure:	30.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.98%	0.02%
Carbon Dioxide	42.67%	57.33%
Methane	4.76%	95.24%
Ethane	16.25%	83.75%
Propane	31.66%	68.34%
Isobutane	43.04%	56.96%
n-Butane	50.59%	49.41%
Other Hexanes	70.02%	29.98%
Methylcyclohexane	94.68%	5.32%
Benzene	99.11%	0.89%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	13.03%	86.97%
Carbon Dioxide	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Other Hexanes	1.43%	98.57%
Methylcyclohexane	4.22%	95.78%
Benzene	5.04%	94.96%

STREAM REPORTS:

WET GAS STREAM

Temperature: 120.00 deg. F
Pressure: 734.70 psia
Flow Rate: 1.25e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.76e-001	1.64e+002
Carbon Dioxide	5.92e+000	8.61e+003
Methane	9.34e+001	4.95e+004
Ethane	3.38e-001	3.36e+002
Propane	2.14e-002	3.12e+001
Isobutane	3.39e-003	6.51e+000
n-Butane	2.69e-003	5.17e+000
Other Hexanes	1.30e-003	3.69e+000
Methylcyclohexane	9.97e-005	3.24e-001
Benzene	9.97e-005	2.57e-001
Total Components	100.00	5.87e+004

DRY GAS STREAM

Temperature: 120.00 deg. F
Pressure: 734.70 psia
Flow Rate: 1.25e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.37e-002	8.15e+000
Carbon Dioxide	5.92e+000	8.59e+003
Methane	9.37e+001	4.95e+004
Ethane	3.39e-001	3.36e+002
Propane	2.15e-002	3.12e+001
Isobutane	3.40e-003	6.50e+000
n-Butane	2.69e-003	5.16e+000
Other Hexanes	1.30e-003	3.68e+000
Methylcyclohexane	9.79e-005	3.17e-001
Benzene	8.64e-005	2.22e-001

Total Components	100.00	5.85e+004

LEAN GLYCOL STREAM

Temperature: 120.00 deg. F
Flow Rate: 8.30e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.95e+001	4.66e+003
Water	5.00e-001	2.34e+001
Carbon Dioxide	4.82e-011	2.26e-009
Methane	7.78e-018	3.64e-016
Ethane	2.42e-009	1.13e-007
Propane	3.19e-011	1.49e-009
Isobutane	6.80e-012	3.18e-010
n-Butane	5.76e-012	2.70e-010
Other Hexanes	2.74e-006	1.28e-004
Methylcyclohexane	6.23e-006	2.91e-004
Benzene	3.94e-005	1.84e-003
Total Components	100.00	4.68e+003

RICH GLYCOL STREAM

Temperature: 120.00 deg. F
Pressure: 734.70 psia
Flow Rate: 8.68e+000 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.56e+001	4.65e+003
Water	3.69e+000	1.80e+002
Carbon Dioxide	4.64e-001	2.26e+001
Methane	2.23e-001	1.08e+001
Ethane	4.93e-003	2.40e-001
Propane	7.55e-004	3.67e-002
Isobutane	2.18e-004	1.06e-002
n-Butane	2.24e-004	1.09e-002
Other Hexanes	2.64e-004	1.28e-002
Methylcyclohexane	1.50e-004	7.28e-003
Benzene	7.60e-004	3.70e-002
Total Components	100.00	4.86e+003

FLASH TANK OFF GAS STREAM

Temperature: 100.00 deg. F
Pressure: 44.70 psia
Flow Rate: 3.59e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.81e-001	3.09e-002
Carbon Dioxide	3.11e+001	1.29e+001

Methane	6.79e+001	1.03e+001
Ethane	7.06e-001	2.01e-001
Propane	6.02e-002	2.51e-002
Isobutane	1.10e-002	6.04e-003
n-Butane	9.77e-003	5.38e-003
Other Hexanes	4.72e-003	3.85e-003
Methylcyclohexane	4.17e-004	3.88e-004
Benzene	4.46e-004	3.29e-004
Total Components	100.00	2.35e+001

FLASH TANK GLYCOL STREAM

Temperature: 100.00 deg. F
Flow Rate: 8.62e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.61e+001	4.65e+003
Water	3.71e+000	1.80e+002
Carbon Dioxide	1.99e-001	9.63e+000
Methane	1.07e-002	5.16e-001
Ethane	8.05e-004	3.90e-002
Propane	2.40e-004	1.16e-002
Isobutane	9.43e-005	4.56e-003
n-Butane	1.14e-004	5.50e-003
Other Hexanes	1.86e-004	8.99e-003
Methylcyclohexane	1.42e-004	6.90e-003
Benzene	7.56e-004	3.66e-002
Total Components	100.00	4.84e+003

FLASH GAS EMISSIONS

Flow Rate: 8.34e+002 scfh
Control Method: Combustion Device
Control Efficiency: 95.00

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.67e+001	2.24e+001
Carbon Dioxide	4.19e+001	4.05e+001
Methane	1.46e+000	5.16e-001
Ethane	1.52e-002	1.00e-002
Propane	1.29e-003	1.26e-003
Isobutane	2.36e-004	3.02e-004
n-Butane	2.10e-004	2.69e-004
Other Hexanes	1.02e-004	1.92e-004
Methylcyclohexane	8.97e-006	1.94e-005
Benzene	9.59e-006	1.65e-005
Total Components	100.00	6.35e+001

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 3.39e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.72e+001	1.56e+002
Carbon Dioxide	2.45e+000	9.63e+000
Methane	3.60e-001	5.16e-001
Ethane	1.45e-002	3.90e-002
Propane	2.96e-003	1.16e-002
Isobutane	8.80e-004	4.56e-003
n-Butane	1.06e-003	5.50e-003
Other Hexanes	1.15e-003	8.87e-003
Methylcyclohexane	7.54e-004	6.60e-003
Benzene	4.99e-003	3.48e-002
Total Components	100.00	1.66e+002

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: South Ignacio - D1 PTE - Feb '19
File Name: \\durnetapp101\Shared\Durango Shared\EHS\Air Permits\GLYCalc files\South Ignacio\SOU D1 2019 02 PTE (uncontrolled).ddf
Date: March 27, 2019

DESCRIPTION:

Description: 30 MMscfd dehy unit; Feb '19 gas analysis, max design gas flow, temp, and pressure; max glycol rate (1 Kimray 50015)

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 120.00 deg. F
Pressure: 720.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	5.9368
Methane	93.6937
Ethane	0.3392
Propane	0.0215
Isobutane	0.0034
n-Butane	0.0027
Other Hexanes	0.0013
Methylcyclohexane	0.0001
Benzene	0.0001

DRY GAS:

Flow Rate: 30.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 0.5 wt% H2O
Flow Rate: 8.3 gpm

PUMP:

Glycol Pump Type: Electric/Pneumatic

FLASH TANK:

Flash Control: Combustion device
Flash Control Efficiency: 95.00 %
Temperature: 100.0 deg. F
Pressure: 30.0 psig

KIMRAY INC.®

GLYCOL PUMPS

ELECTRIC PUMPS

APPLICATIONS:

- Circulating pump for gas glycol dehydrators, gas amine units and other pumping applications.

FEATURES:

- No Gas Emissions
- No Packing
- Hydraulically Balanced Diaphragms
- Double-ended Shaft
- Stud Extenders for easy Head Installation
- Pulse-Free flow
- Direct or Belt Driven

SPECIFICATIONS:

- Capacity @ max. pressure: rpm gpm l/min
  1500 psi (103 bar) 1200 8.3 31.4
- RPM: 1200 max.- 200 min.
- Inlet
  250 psi max
- Connections:
  Inlet: 1" NPT
  Outlet: 3/4" NPT
- Temperature:
  Max: 250° F (121.1° C)
  Min: 40° F (4.4° C)
  [contact factory for temperatures below 40° F (4.4° C)]
- Fluid End Material, Manifold : SA395 / SA479
- Elastomers: Highly Saturated Nitrile
- Oil Capacity: 2.75 quarts KIMRAY Part No. 7266
  2.60 Liters
- Weight (dry): 100 lbs (45.7 kg)
- Bi Directional Shaft Rotation

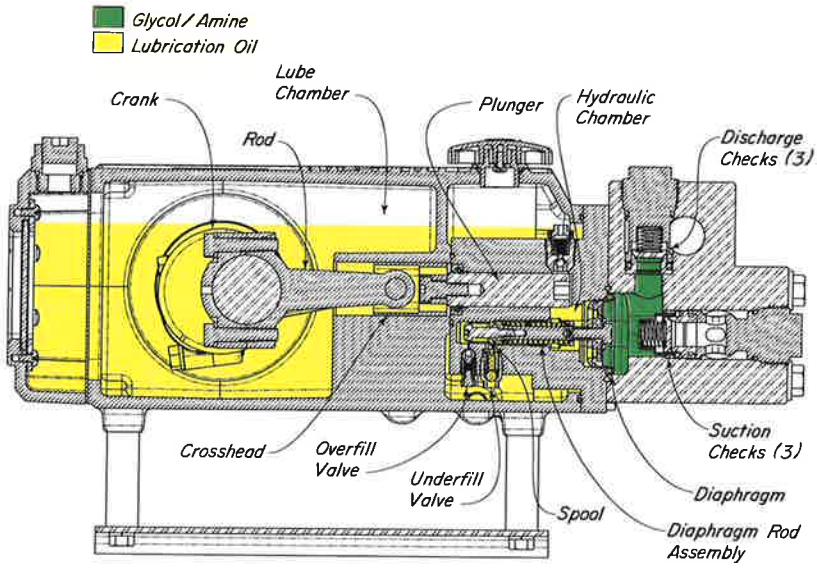
OPERATION:

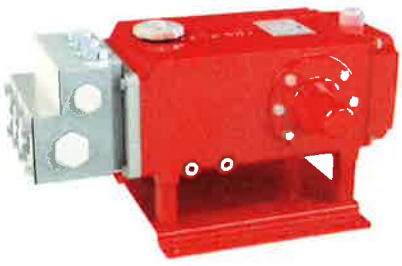
The KIMRAY ELECTRIC GLYCOL PUMP is a uniquely designed hydraulically balanced diaphragm/plunger positive displacement pump. Power to the pump is provided by a properly sized and specified electric motor either directly connected or belt driven. PLUNGERS are utilized to energize DIAPHRAGMS which in turn pressurize glycol/amine solutions used in gas processing. The Plungers operate and are lubricated in clean oil isolated from the process fluids by DIAPHRAGMS. The DIAPHRAGMS are in contact with the hydraulic oil on one side and the glycol/amine solution and on the other side. KIMZOIL EGP1 is a hydraulic/lubrication oil designed for high end pump performance designed for this application. This design allows for the protection of the reciprocating pumping internals from the process fluids.

As shown in the diagram, the PLUNGER(S) are connected to the CROSSHEAD(s) and displace the oil (YELLOW) in the HYDRAULIC CHAMBER as they reciprocate. As the Plunger moves to the right on the pressure stroke, oil is displaced in the Hydraulic Chamber and forces the DIAPHRAGM(s) to move to the right. The Diaphragm movement displaces the glycol/amine solution (GREEN) on the opposing side of the Diaphragm and forces it through the DISCHARGE CHECK VALVE(s). During the pressure stroke, a small amount of oil (YELLOW) leaks past the clearance between the Plunger and cylinder.

As the Plunger moves back on the suction stroke, the pressure drops in the Hydraulic Chamber and a small amount of oil is drawn in through the UNDER-FILL VALVE to replace the oil lost during the pressure stroke. The position of the Spool Valve regulates how much oil is drawn in. The SPOOL VALVE is positioned by the DIAPHRAGM ROD ASSEMBLY which is connected to the Diaphragm. The cycle then repeats.

When the Diaphragm moves too far forward, the Under-Fill port closes and the Over-Fill port opens. The Under-Fill Valve is a check valve that lets oil in during the suction stroke, but will not allow oil to leave. The OVER-FILL VALVE is a check valve that lets oil out during the pressure stroke, but prevents oil from coming in. The spool valve position opens the port to one of the two valves depending on the need for more or less oil.





Kimray is an ISO 9001- certified manufacturer.

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: South Ignacio - D2 PTE - Feb '19
File Name: \\durnetapp101\Shared\Durango Shared\EHS\Air Permits\GLYCalc files\South Ignacio\D2\SOU D2 2019 02.ddf
Date: March 27, 2019

DESCRIPTION:

Description: 40 MMscfd dehy unit; Feb '19 gas analysis; max design gas flow, temp, and pressure; max glycol rate (3-Kimray 20015)

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.8086	19.405	3.5415
Ethane	0.0278	0.668	0.1219
Propane	0.0070	0.167	0.0304
Isobutane	0.0027	0.066	0.0120
n-Butane	0.0033	0.080	0.0146
Other Hexanes	0.0067	0.162	0.0295
Methylcyclohexane	0.0087	0.208	0.0379
Benzene	0.0565	1.355	0.2473
Total Emissions	0.9213	22.111	4.0352
Total Hydrocarbon Emissions	0.9213	22.111	4.0352
Total VOC Emissions	0.0849	2.037	0.3718
Total HAP Emissions	0.0565	1.355	0.2473
Total BTEX Emissions	0.0565	1.355	0.2473

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	5.3786	129.086	23.5582
Ethane	0.0465	1.116	0.2036
Propane	0.0051	0.122	0.0222
Isobutane	0.0012	0.029	0.0053
n-Butane	0.0011	0.026	0.0048
Other Hexanes	0.0010	0.023	0.0043
Methylcyclohexane	0.0002	0.004	0.0007
Benzene	0.0002	0.004	0.0008
Total Emissions	5.4338	130.410	23.7999
Total Hydrocarbon Emissions	5.4338	130.410	23.7999
Total VOC Emissions	0.0087	0.209	0.0381
Total HAP Emissions	0.0002	0.004	0.0008
Total BTEX Emissions	0.0002	0.004	0.0008

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	107.5715	2581.716	471.1631
Ethane	0.9297	22.313	4.0721
Propane	0.1015	2.437	0.4447
Isobutane	0.0244	0.585	0.1067
n-Butane	0.0219	0.525	0.0958
Other Hexanes	0.0195	0.469	0.0856
Methylcyclohexane	0.0033	0.078	0.0143
Benzene	0.0036	0.085	0.0156
Total Emissions	108.6753	2608.207	475.9977
Total Hydrocarbon Emissions	108.6753	2608.207	475.9977
Total VOC Emissions	0.1741	4.178	0.7626
Total HAP Emissions	0.0036	0.085	0.0156
Total BTEX Emissions	0.0036	0.085	0.0156

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	6.1871	148.491	27.0996
Ethane	0.0743	1.784	0.3255
Propane	0.0120	0.289	0.0527
Isobutane	0.0040	0.095	0.0174
n-Butane	0.0044	0.106	0.0194
Other Hexanes	0.0077	0.185	0.0338
Methylcyclohexane	0.0088	0.212	0.0386
Benzene	0.0566	1.359	0.2481
Total Emissions	6.3550	152.521	27.8351
Total Hydrocarbon Emissions	6.3550	152.521	27.8351
Total VOC Emissions	0.0936	2.246	0.4099
Total HAP Emissions	0.0566	1.359	0.2481
Total BTEX Emissions	0.0566	1.359	0.2481

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	474.7045	27.0996	94.29
Ethane	4.1940	0.3255	92.24
Propane	0.4751	0.0527	88.91
Isobutane	0.1187	0.0174	85.38
n-Butane	0.1104	0.0194	82.42
Other Hexanes	0.1151	0.0338	70.64
Methylcyclohexane	0.0522	0.0386	26.00
Benzene	0.2629	0.2481	5.63
Total Emissions	480.0329	27.8351	94.20
Total Hydrocarbon Emissions	480.0329	27.8351	94.20
Total VOC Emissions	1.1344	0.4099	63.86
Total HAP Emissions	0.2629	0.2481	5.63
Total BTEX Emissions	0.2629	0.2481	5.63

EQUIPMENT REPORTS:

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	2.49 lbs. H2O/MMSCF
Temperature:	100.0 deg. F
Pressure:	720.0 psig
Dry Gas Flow Rate:	42.0000 MMSCF/day
Glycol Losses with Dry Gas:	0.3733 lb/hr
Wet Gas Water Content:	Saturated
Calculated Wet Gas Water Content:	74.99 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	4.72 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.31%	96.69%
Carbon Dioxide	99.74%	0.26%
Methane	99.98%	0.02%
Ethane	99.93%	0.07%
Propane	99.89%	0.11%
Isobutane	99.84%	0.16%
n-Butane	99.79%	0.21%
Other Hexanes	99.63%	0.37%
Methylcyclohexane	97.51%	2.49%
Benzene	83.48%	16.52%

FLASH TANK

Flash Control:	Combustion device
Flash Control Efficiency:	95.00 %
Flash Temperature:	100.0 deg. F
Flash Pressure:	30.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.88%	0.12%
Carbon Dioxide	10.00%	90.00%
Methane	0.75%	99.25%
Ethane	2.91%	97.09%
Propane	6.41%	93.59%
Isobutane	10.13%	89.87%
n-Butane	13.24%	86.76%
Other Hexanes	26.19%	73.81%
Methylcyclohexane	73.67%	26.33%
Benzene	94.37%	5.63%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	18.13%	81.87%
Carbon Dioxide	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Other Hexanes	2.80%	97.20%
Methylcyclohexane	5.16%	94.84%
Benzene	5.25%	94.75%

STREAM REPORTS:

WET GAS STREAM

Temperature: 100.00 deg. F
Pressure: 734.70 psia
Flow Rate: 1.75e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.58e-001	1.31e+002
Carbon Dioxide	5.93e+000	1.21e+004
Methane	9.35e+001	6.93e+004
Ethane	3.39e-001	4.71e+002
Propane	2.15e-002	4.37e+001
Isobutane	3.39e-003	9.12e+000
n-Butane	2.70e-003	7.24e+000
Other Hexanes	1.30e-003	5.17e+000
Methylcyclohexane	9.98e-005	4.53e-001
Benzene	9.98e-005	3.60e-001
Total Components	100.00	8.21e+004

DRY GAS STREAM

Temperature: 100.00 deg. F
Pressure: 734.70 psia
Flow Rate: 1.75e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.24e-003	4.36e+000
Carbon Dioxide	5.92e+000	1.20e+004
Methane	9.37e+001	6.93e+004
Ethane	3.39e-001	4.70e+002
Propane	2.15e-002	4.37e+001
Isobutane	3.40e-003	9.10e+000
n-Butane	2.70e-003	7.22e+000
Other Hexanes	1.30e-003	5.15e+000
Methylcyclohexane	9.75e-005	4.42e-001
Benzene	8.35e-005	3.01e-001

Total Components	100.00	8.19e+004

LEAN GLYCOL STREAM

Temperature: 100.00 deg. F
Flow Rate: 9.99e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.95e+001	5.60e+003
Water	5.00e-001	2.82e+001
Carbon Dioxide	5.62e-011	3.16e-009
Methane	7.95e-018	4.48e-016
Ethane	2.62e-009	1.47e-007
Propane	3.50e-011	1.97e-009
Isobutane	7.78e-012	4.38e-010
n-Butane	6.73e-012	3.79e-010
Other Hexanes	3.44e-006	1.94e-004
Methylcyclohexane	8.35e-006	4.70e-004
Benzene	5.56e-005	3.13e-003
Total Components	100.00	5.63e+003

RICH GLYCOL AND PUMP GAS STREAM

Temperature: 100.00 deg. F
Pressure: 734.70 psia
Flow Rate: 1.06e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.47e+001	5.60e+003
Water	2.63e+000	1.55e+002
Carbon Dioxide	8.15e-001	4.82e+001
Methane	1.83e+000	1.08e+002
Ethane	1.62e-002	9.58e-001
Propane	1.83e-003	1.08e-001
Isobutane	4.58e-004	2.71e-002
n-Butane	4.26e-004	2.52e-002
Other Hexanes	4.48e-004	2.65e-002
Methylcyclohexane	2.09e-004	1.24e-002
Benzene	1.07e-003	6.31e-002
Total Components	100.00	5.91e+003

FLASH TANK OFF GAS STREAM

Temperature: 100.00 deg. F
Pressure: 44.70 psia
Flow Rate: 2.94e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.29e-001	1.79e-001
Carbon Dioxide	1.27e+001	4.34e+001

Methane	8.67e+001	1.08e+002
Ethane	4.00e-001	9.30e-001
Propane	2.98e-002	1.02e-001
Isobutane	5.42e-003	2.44e-002
n-Butane	4.86e-003	2.19e-002
Other Hexanes	2.93e-003	1.95e-002
Methylcyclohexane	4.29e-004	3.26e-003
Benzene	5.88e-004	3.55e-003
Total Components	100.00	1.52e+002

FLASH TANK GLYCOL STREAM

Temperature: 100.00 deg. F
Flow Rate: 1.03e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.72e+001	5.60e+003
Water	2.69e+000	1.55e+002
Carbon Dioxide	8.36e-002	4.82e+000
Methane	1.40e-002	8.09e-001
Ethane	4.83e-004	2.78e-002
Propane	1.21e-004	6.95e-003
Isobutane	4.76e-005	2.74e-003
n-Butane	5.79e-005	3.34e-003
Other Hexanes	1.20e-004	6.93e-003
Methylcyclohexane	1.58e-004	9.12e-003
Benzene	1.03e-003	5.96e-002
Total Components	100.00	5.76e+003

FLASH GAS EMISSIONS

Flow Rate: 7.82e+003 scfh
Control Method: Combustion Device
Control Efficiency: 95.00

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.23e+001	2.32e+002
Carbon Dioxide	3.60e+001	3.27e+002
Methane	1.63e+000	5.38e+000
Ethane	7.50e-003	4.65e-002
Propane	5.58e-004	5.08e-003
Isobutane	1.02e-004	1.22e-003
n-Butane	9.12e-005	1.09e-003
Other Hexanes	5.50e-005	9.77e-004
Methylcyclohexane	8.05e-006	1.63e-004
Benzene	1.10e-005	1.78e-004
Total Components	100.00	5.64e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 2.74e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.78e+001	1.27e+002
Carbon Dioxide	1.52e+000	4.82e+000
Methane	6.98e-001	8.09e-001
Ethane	1.28e-002	2.78e-002
Propane	2.18e-003	6.95e-003
Isobutane	6.54e-004	2.74e-003
n-Butane	7.95e-004	3.34e-003
Other Hexanes	1.08e-003	6.74e-003
Methylcyclohexane	1.22e-003	8.65e-003
Benzene	1.00e-002	5.65e-002
Total Components	100.00	1.33e+002

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: South Ignacio - D2 PTE - Feb '19
File Name: \\durnetapp101\Shared\Durango Shared\EHS\Air Permits\GLYCalc files\South Ignacio\D2\SOU D2 2019 02.ddf
Date: March 27, 2019

DESCRIPTION:

Description: 40 MMscfd dehy unit; Feb '19 gas analysis; max design gas flow, temp, and pressure; max glycol rate (3-Kimray 20015)

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 100.00 deg. F
Pressure: 720.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	5.9368
Methane	93.6937
Ethane	0.3392
Propane	0.0215
Isobutane	0.0034
n-Butane	0.0027
Other Hexanes	0.0013
Methylcyclohexane	0.0001
Benzene	0.0001

DRY GAS:

Flow Rate: 42.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 0.5 wt% H2O
Flow Rate: 10.0 gpm

PUMP:

Glycol Pump Type: Gas Injection
Gas Injection Pump Volume Ratio: 0.080 acfm gas/gpm glycol

FLASH TANK:

Flash Control: Combustion device
Flash Control Efficiency: 95.00 %
Temperature: 100.0 deg. F

Pressure: 30.0 psig

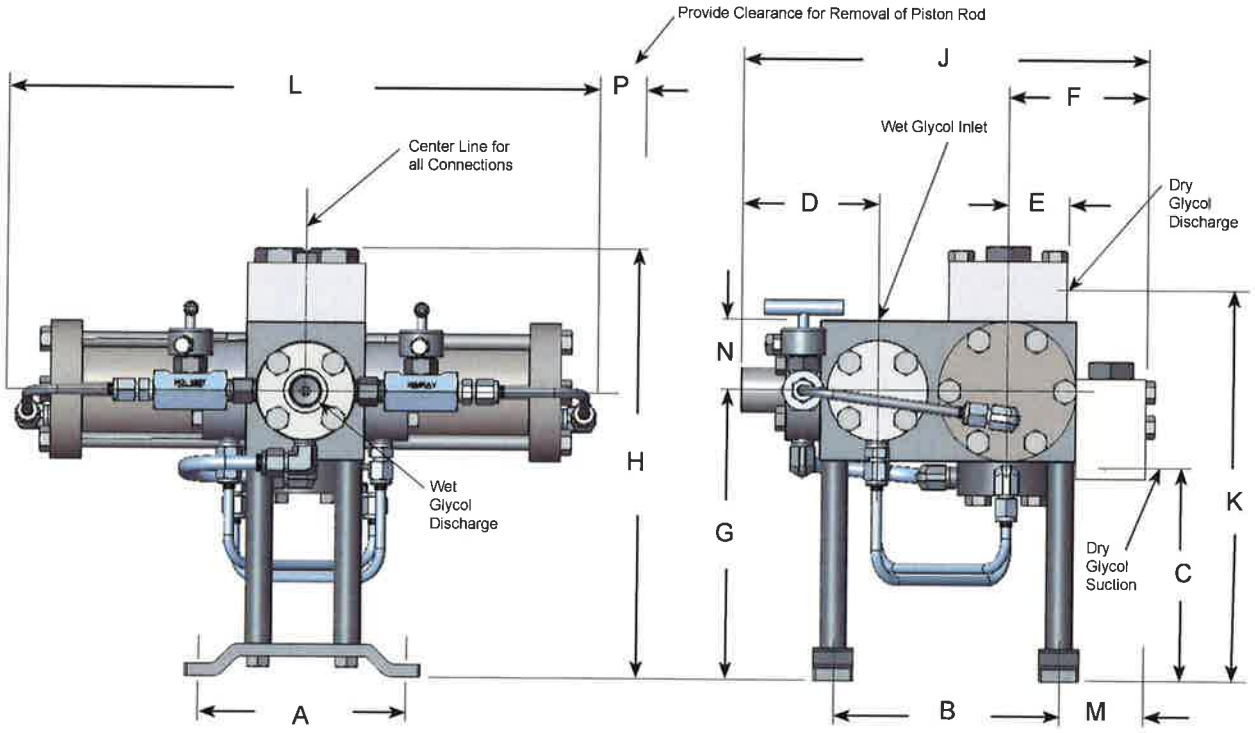


Figure 7

Table 3 - Glycol Pump Dimensions

Model PV, SC	A	B	C	D	E	F	G	H	J	K	L	M	N	P
1720 PV	5 1/4 in. (133 mm)	5 11/16 in. (144 mm)	5 3/4 in. (146 mm)	5 7/16 in. (87 mm)	1 1/2 in. (38 mm)	3 1/2 in. (88 mm)	7 1/4 in. (184 mm)	10 7/8 in. (276 mm)	10 3/16 in. (258 mm)	9 5/8 in. (244 mm)	15 in. (381 mm)	2 1/8 in. (53 mm)	1 3/4 in. (44 mm)	3 in. (76 mm)
4020 PV & 2015 SC	5 1/4 in. (133 mm)	5 11/16 in. (144 mm)	5 3/4 in. (146 mm)	5 7/16 in. (87 mm)	1 1/2 in. (38 mm)	3 1/2 in. (88 mm)	7 1/4 in. (184 mm)	10 7/8 in. (276 mm)	10 3/16 in. (258 mm)	9 5/8 in. (244 mm)	15 in. (381 mm)	2 1/8 in. (53 mm)	1 3/4 in. (44 mm)	3 in. (76 mm)
9020 PV & 5015 SC	6 1/4 in. (158 mm)	5 11/16 in. (144 mm)	6 3/8 in. (161 mm)	5 in. (127 mm)	1 3/4 in. (44 mm)	4 1/4 in. (107 mm)	8 3/4 in. (222 mm)	13 1/4 in. (336 mm)	13 7/8 in. (352 mm)	11 3/4 in. (289 mm)	20 in. (508 mm)	2 1/2 in. (63 mm)	2 in. (50 mm)	3 in. (76 mm)
21020 PV & 10015 SC	7 5/8 in. (193 mm)	10 1/8 ± 1/8 (257 mm)	7 in. (177 mm)	5 3/8 in. (136 mm)	2 1/4 in. (57 mm)	5 3/4 in. (146 mm)	9 1/4 in. (234 mm)	14 3/4 in. (374 mm)	16 5/8 in. (422 mm)	13 in. (330 mm)	24 in. (508 mm)	3 3/16 in. (80 mm)	2 1/2 in. (63 mm)	4 in. (101 mm)
45020 PV & 20015 SC	10 3/4 in. (273 mm)	14 ± 1/8 (355 mm)	9 in. (228 mm)	6 5/8 in. (168 mm)	2 5/8 in. (66 mm)	6 1/2 in. (165 mm)	11 3/8 in. (288 mm)	19 in. (482 mm)	21 1/8 in. (536 mm)	16 3/8 in. (415 mm)	34 in. (863 mm)	3 3/4 in. (95 mm)	3 1/2 in. (88 mm)	6 in. (152 mm)

Table 4 - Glycol Pump Specifications

Model Number	Max. Cap		Size of Pipe Connections	Mounting Bolts	Approx. Weight	Max. Strokes Per Minute	Glycol Output Strokes / Gal.	Glycol Output Gal. / Strokes
	G.P.M	G.P.H						
1720 PV	.67	40	1/2 in NPT (12 mm)	3/8 in. dia (9.42 mm)	66 lbs (29.93 kg)	40	59	0.017
4020 PV	.67	40	1/2 in NPT (12 mm)	3/8 in. dia (9.42 mm)	66 lbs (29.93 kg)	40	59	0.017
9020 PV	1.5	90	3/4 in NPT (19 mm)	1/2 in. dia (12 mm)	119 lbs (53.97 kg)	40	26.3	0.038
21020 PV	3.5	210	1 in NPT (25 mm)	1/2 in. dia (12 mm)	215 lbs (97.52 kg)	32	9	0.111
45020 PV	7.5	450	1 1/2 in NPT (38 mm)	1/2 in. dia (12 mm)	500 lbs (22.68 kg)	28	3.5	0.283
2015 SC	.33	20	1/2 in NPT (12 mm)	3/8 in. dia (9.52 mm)	66 lbs (29.93 kg)	55	147	0.0068
5015 SC	.83	50	3/4 in NPT (19 mm)	1/2 in. dia (12 mm)	119 lbs (53.97 kg)	50	52	0.019
10015 SC	1.67	100	1 in NPT (25 mm)	1/2 in. dia (12 mm)	215 lbs (97.52 kg)	48	25	0.040
20015 SC	3.33	200	1 1/2 in NPT (38 mm)	1/2 in. dia (12 mm)	500 lbs (22.68 kg)	40	8.8	0.114